JULY, 1941.

GENERAL PHYSICS.

ATOMIC AND MOLECULAR STRUCTURE.

1091. Tracks of nuclear particles in photographic emulsions. M. M. Shapiro. *Rev. Mod. Phys.*, **13,** *pp.* 58–71, *Jan.*, 1941.—The development of photographic recording of nuclear reactions is discussed historically and the advantages and limitations of the method are reviewed. The contributions of the photographic method in cosmic-ray studies and in problems of nuclear physics, e.g. recording proton tracks, recoil tracks, α-particle tracks, nuclear fission, are stated. W.R.A.

1092. Non-uniform particle density in nuclear structure. E. Feenberg. *Phys. Rev.*, **59,** *pp.* 593–597, *April* 1, 1941.—The Coulomb repulsion between protons must give rise to a tendency for the proton density to vary within a nucleus from a min. value at the centre to a max. near the boundary. A non-uniform proton density may be expected to create forces which distort the neutron distribution and tend to make the two distributions vary in the same manner. If surface effects are neglected, it is possible to calculate the energy correction associated with the non-uniform densities without making special assumptions about the nuclear forces. The neglect of surface effects permits the assumption that the variations in density are small departures from essentially constant distributions. It is found that the departure from uniform density is appreciable in heavy nuclei, but the energy correction is negligible. Author.

1093. Statistics of excited energy states of nuclei. H. Margenau. *Phys. Rev.*, **59,** *pp.* 627–632, *April* 15, 1941.—The spacing of nuclear energy levels at excitation energies of about 8 eMV is calculated by numerical summation over the individual particle states, thus avoiding the use of the asymptotic Sommerfeld formulae, whose validity in nuclear considerations is far from exact. The model used as basis is that of free particles moving in a spherical well. The results indicate that deviations from Bethe's formula for the level density, which represents correctly the mean trend with both excitation energy and atomic number, can be great. The group structure introduced by the free-particle model has a strong effect on the spacing. The fluctuations thus shown to exist permit an explanation of the fact that heavy nuclei, which according to current theory should be strong absorbers of slow neutrons, do not as a rule possess this property. Author.

1094. Excitation of the H molecule by electron impact. R. Roscoe. *Phil. Mag.*, **31,** *pp.* 349–362, *May*, 1941.—Calculations are made of the inelastic scattering of electrons in molecular hydrogen, using the Born approximation. The differential cross-section for the aggregate of inelastically scattered electrons, and also the cross-sections corresponding to the excitation of individual states, are found to decrease steadily with increasing angle and voltage, showing no evidence of diffraction max. or min. The *B* and *C* states give very similar scattering curves, and a finite cross-section is obtained for the ^1X state even at high voltages, indicating that the optically forbidden $A \rightarrow {}^1X$ transition can occur under electron excitation. The scattering curves for the different states strongly resemble the curves for the corresponding states of He. It is found that the use of 2 different types of wave function for the *B* state leads to 2 very similar results for the scattering. The Frank-Condon principle fails to give correct values for the relative probabilities of excitation of the vibrational levels. Author.

1095. Adsorption and N_2 isotope exchange on metallic Os catalysts. W. R. F. Guyer, G. G. Joris and H. S. Taylor. *J. Chem. Phys.* **9,** *pp.* 287–294, *April*, 1941.—Suitably prepared Os catalysts show activated absorption of H_2 between 80° and 537° abs., with some van der Waals adsorption at the lower temperature. The N_2 isobar for the same catalyst at 1 atm. shows a min. at 350° abs., above which activated adsorption occurs up to a max. at 428° abs. The area per g. of catalyst at 80° abs. is 30·8 m²., only 4% of which is covered by N_2 at 428° abs. The N_2 isotope exchange reaction $N_2^{28} + N_2^{30} = 2\,N_2^{29}$ on these catalysts is just measurable at 473° abs. and is very rapid at 573° abs., with an activation energy of 21·8 k. cal. At 573° abs. NH_3 decomposes into $N_2 + 3H_2$ at least 6 times as fast as the exchange reaction takes place. Alternative exchange mechanisms are discussed. C. B. A.

1096. Separation and use of stable isotopes. H. C. Urey. *J. Appl. Phys.*, **12,** *pp.* 270–278, *April*, 1941.

1097. Structure and molecular anisotropy of sorbic acid, $CH_3 . CH : CH . CH : CH . COOH$. K. Lonsdale, J. M. Robertson and I. Woodward. *Proc. Roy. Soc. A*, **178,** *pp.* 43–52, *May* 9, 1941.—A preliminary study of sorbic acid shows that the monoclinic unit cell contains 8 molecules, linked in pairs by H bonds about the symmetry centres of the crystal, with the long chain axis of the molecule in or near to the (010) plane and inclined at between 10° and 15° to the *a*-axis in the obtuse angle β. The molecular chains must be rotated so as to bring some of the atoms out of the (010) plane, and an approximate measure of this rotation is provided by measurements of optical and magnetic anisotropy, which give $\pm$ 35° as the angle between the *b*-axis and the normal to the molecular plane. The magnetic anisotropy due to resonance in the conjugated carbon chain is about half as large as that in the benzene ring and falls into line with previous observations on non-cyclic conjugated compounds. The orientation of the molecules is confirmed by observation of the size and shape of the diffuse spots occurring on well-exposed Laue photographs taken with radiation from a copper target, and the usefulness of these photographs as a secondary method of structure determination is emphasized. AUTHORS.

1098. Kinetics of polymerization of isoprene on sodium surfaces. J. L. BOLLAND. *Proc. Roy. Soc. A*, **178**, *pp.* 24–42, *May* 9, 1941.—The kinetics of the polymerization of isoprene liquid and vapour occurring on Na surfaces are investigated at 60° and 25°C. In the case of the liquid phase polymerization diffusion of monomer to the catalytic surface is shown to be the rate-controlling factor, except when the Na surface is in the form of a sphere of sufficiently small dimensions. The kinetics of the polymerization in presence of toluene are consistent with the view that polymeric chains are initiated by formation of free radicles on the Na surface, the subsequent propagation occurring while the polymer is still attached to the Na; termination occurs exclusively by interaction with toluene. In absence of toluene an alternative termination-reaction, leading to cross-linking and requiring 4·6 k.cal. more activation energy than the process involving toluene, comes into play. AUTHOR.

1099. Catalytic isomerization of butene-1. G. H. TWIGG. *Proc. Roy. Soc. A*, **178**, *pp.* 106–117, *May* 9, 1941.

1100. Vapour density of hydrazine. P. A. GIGUÈRE AND R. E. RUNDLE. *J. Amer. Chem. Soc.* **63**, *pp.* 1135–1137, *April*, 1941.—The vapour density of 99·4% pure hydrazine, N_2H_4, was measured both at atmospheric pressure and at lower pressures. In contradiction to the claim made by Eucken and Krome [Abstr. 2672 (1940)] the results obtained show that hydrazine is not associated in the vapour phase. This conclusion is confirmed by electron-diffraction and spectroscopic investigations. AUTHORS.

See also Abstracts 1294, 1295, 1296.

COLLOIDS.

1101. The silver sol. H. R. KRUYT AND H. L. VAN NOUHUYS. *Kolloid Zschr.*, **92**, *pp.* 325–342, *Sept.*, 1940. *In German.*—The conditions under which peptization takes place and the behaviour of the sols thus prepared in the presence of several electrolytes were investigated. The silver sol is peptized by complex ions. Reversible reaction formulae are given for this peptization as dependent on the constitution of the sol medium. A table shows some examples of the concentrations of the silver ions, the OH and H^+ ions, the halogen ions and the type of complex ion. Potential curves are drawn, taking into account that silver particles are at the silver potential with respect to the intermicellar liquid. R. N.

1102. Importance of dialysis in the study of colloids. VII. Colloidal $Zn_2Fe(CN)_6$. V. C. VORA, P. M. BARVE AND B. N. DESAI. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 100–107, *Feb.*, 1941.—Changes in the cataphoretic speed *s*, stability, and conductivity κ, of colloidal $Zn_2Fe(CN)_6$ dialysed, diluted, aged and exposed to sunlight for different periods, are studied. With the progress of dialysis *s* first increases and then decreases, while stability and κ continuously decrease. In the case of sols dialysed for periods shorter than the max. in the *s*-dialysis curve *s* first increases and then decreases on dilution, while for sols dialysed for longer periods *s* continuously decreases. Stability and κ continuously decrease on dilution in all cases. For sols dialysed for short periods *s* first increases and then decreases on adding small increasing amounts of KCl, K_2SO_4, $K_4Fe(CN)_6$, $MgCl_2$ and $MgSO_4$; for sols dialysed for long periods *s* continuously decreases with all except $K_4Fe(CN)_6$, where it first increases and then decreases. The idea of critical potential is not supported. On allowing both the short- and long-period dialysed sols to age, or exposing them to sunlight, *s*, stability and κ continuously decrease. Results are interpreted on assumptions previously employed for other colloids. [Abstr. 893 (1939)]. N. M. B.

1103. Freezing-out of Fe_2O_3 hydrosols as dependent on their constitution and the method of freezing. A. LOTTERMOSER AND G. SCHMOLE. *Kolloid Zschr.*, **89**, *pp.* 328–340, *Dec.*, 1939. *In German.*—The authors investigate the conditions under which the change takes place from a reversibly thawing sol to a non-reversible state and vice versa. The content of electrolyte, the dialysis and especially the ratio of ultra Cl to total Cl, are important factors. Irreversibly thawing sols become turbid before freezing. Their flocculation must therefore be due to a change in the constitution of the sol dependent on concentration. During the concentration caused by the cooling of irreversibly thawing sols part of the ultra Cl migrates to the inside. A state of equilibrium exists between the Cl content outside and that inside the colloid electrolyte. The change of dialysed irreversibly thawing to reversibly thawing sols takes a considerable time. The behaviour of a sol when frozen out seems to depend to a large extent on the quantity of the freely movable Cl outside the colloid electrolyte. The ratio of this Cl content to compensating Cl follows closely the changes of concentration. R. N.

1104. Relations between electric conductivity and degree of dispersion of lyophile colloids. III. Conductivity of sodium and potassium palmitate and stearate solutions in presence of meta- and para-cresol. E. ANGELESCU AND A. WOINAROSKY. *Kolloid Zschr.*, **92**, *pp.* 355–361, *Sept.*, 1940. *In German.*—The experiments described in previous papers [Abstr. 458 (1941)] are continued and extended to the presence of meta- and para-cresol. The previous results are confirmed. The max. values of viscosity and conductivity correspond to different concentrations of the cresol. The max. viscosity is not noticeable by the change in conductivity as the latter does not diminish but rises with a strong increase in viscosity. The isomerism of the cresol has a strong influence on viscosity but not on conductivity. All this proves that the particles causing the rise in viscosity and those taking part in the electrical transport are not identical. R. N.

1105. Studies on silicic-acid gels. XI. Effect of concentration of silica upon time of set. C. B. HURD AND H. E. SHEFFER. *J. Phys. Chem.*, **45**, *pp.* 588–594, *April*, 1941.—[Abstr. 11 (1941)]. In a study of the effect of the concentration of silica upon the time of set in silicic-acid gel mixtures produced by mixing solutions of sodium silicate and acetic acid, in the *p*H range from 4·8 to 6·5, the following observations were made. The time of set of these mixtures at a fixed temperature and a constant silica concentration is proportional to the *p*H. This holds for each silica concentration. The time of set appears to be inversely proportional to the square of the silica concentration at a fixed temperature and *p*H. AUTHORS.

1106. Instructional experiments on double refraction of elastine fibres. W. J. SCHMIDT. *Kolloid Zschr.*, **89**, *pp.* 233–237, *Nov.*, 1939. *In German.*

1107. Hydration of curd fibres of sodium palmitate and sodium oleate. J. W. MCBAIN, M. J. VOLD AND S. A. JOHNSTON. *J. Amer. Chem. Soc.*, **63**, *pp.* 1000–1007, *April*, 1941.—The activity of water in soap curd was determined by measurement of the vapour pressure at constant temperature and of the amount of ice formed at various temperatures, as functions of total composition. Water in excess of 40% for sodium palmitate or 60% for sodium oleate is not chemically combined or sorbed, although its activity is slightly and progressively lowered by confinement in capillary spaces of the order of 10^{-4} cm. dia. AUTHORS.

1108. Strength/elongation diagrams of isotropic cellulose fibres from the standpoint of theoretical relations between anisotropy of swelling, orientation, and strength. I. Threads of different degree of swelling. P. H. HERMANS. **II. Threads of different methods of manufacture.** P. H. HERMANS AND P. PLATZEK. *Kolloid Zschr.*, **89**, *pp.* 344–354, *Dec.*, 1939. *In German.*—By introducing a characteristic degree of elongation based on the dried state of the thread the curves showing the elongation as function of tension are arranged in the order of degrees of swelling. The trend and relative location of these curves may be represented according to theoretical considerations as a set of the same general equation, the stress at the yield point being used as a parameter. Up to about 150% elongation the strength is inversely proportional to the sine of the average angle of micellar orientation. In the second part it is shown that, for fibres produced from sols of different concentrations, the trend of the curves depends on the conditions prevailing during coagulation. R. N.

1109. Types of micelles in aqueous soap solutions. J. STAUFF. *Kolloid Zschr.*, **89**, *pp.* 224–233, *Nov.*, 1939. *In German.*—X-ray spectroscopy reveals that at certain concentrations large liquid crystalline micelles are present, consisting of the system soap/water, the water being interspersed between the polar groups of soap molecules. With regard to electric charge there is only one kind of micelles, as postulated by Hartley. As far as size, shape and space filling are concerned 2 different kinds may be distinguished, in accordance with McBain. The generation of the large micelles explains the min. value in the conductivity curves and the osmotic behaviour of the solution. R. N.

1110. Development and present state of the theory of filtration of suspensions. A. BRIEGHEL-MÜLLER. *Kolloid Zschr.*, **92**, *pp.* 285–299, *Sept.*, 1940. *In German.*—The author gives a critical review of the literature concerning the theory of technical filtration. The assumptions and limitations of Poiseuille's formula are discussed. One method assumes the filtering speed to be a power function of filtering pressure and volume of filtrate, this function to be determined by experiment, the other postulates parallelism between increase of resistance and volume of filtrate. Although the latter appears more plausible, theoretical and empirical results do not agree. The author proposes a programme of empirical research in which the actual change in resistance during the course of filtration is determined and related to the volume of filtrate. A Bibliography of 72 publications is given. R. N.

1111. Importance of capillary analysis in physical therapeutics. H. Lampert and H. Rohlinger. *Kolloid Zschr.*, **89**, *pp.* 271–286, *Nov.*, 1939. *In German.*—For balneological purposes the authors investigated the methods and results of capillary and capillary-luminescence analysis. The quality and origin of different muds may be determined with comparatively simple means. Solutions in 96% and 60% alcohol are used for determining the organic and anorganic constituents respectively. The presence and colour of luminiscence when irradiating the filter paper test strips with ultra-violet light, in combination with the total height of capillary rise, furnish a criterion for the quality and the origin of the mud. R. N.

1112. Dielectric behaviour of colloidal systems. H. Schaefer and R. Stachowiak. *Kolloid Zschr.*, **89**, *pp.* 311–316, *Nov.*, 1939. *In German.*—This is an electro-biological investigation of the dielectric constant of animal liver substance as a function of wavelength. The authors give a short survey of the dielectric phenomena with a single particle in electric fields of different frequencies. Measurements were carried out with a complex bridge system in combination with a substitution method in the range of wavelengths between 300 and 10000 m. Previous measurements for wavelengths of 3, 6 and 12 m. fit in well with the present results. R. N.

1113. Burton's rule applied to positive hydrosols. H. Kauffmann. *Kolloid Zschr.*, **92**, *pp.* 343–354, *Sept., and* **93**, *pp.* 86–103, *Oct.*, 1940. *In German.*—According to Burton's rule the coagulation values of monovalent ions decrease, those of trivalent ions increase, with increasing concentration, while bivalent ions show an intermediate behaviour. A critical survey is given of the literature concerning the validity of this rule for positive hydrosols, especially in combination with the theory of the activity coefficient. Apparatus is described incorporating a vibrator for producing concentrated sols of CuO, Al_2O_3 and Fe_2O_3 by electric disintegration. Experiments based on Wannow's optical method [Abstr. 598 (1940)] are described. Besides the electrically generated sols, chemically produced sols of $Fe(OH)_3$ and $Cr(OH)_3$ are investigated. While the validity of Burton's rule could be proved for the former, the behaviour of the latter is more complicated although following the rule with some modification. Dependent on different concentrations of the sol, coagulation takes place with different final values of turbidity. The curve shows a min., which is explained. The results of the investigations are in agreement with the general experience, that the application of the theory of the activity coefficient to coagulation phenomena of hydrosols is the more successful the more hydrophobe the sols. [See Abstr. 26 and 3851 (1939).] R. N.

1114. Effect of centrifugeing on the viscosity of living protoplasma. E. Küster. *Kolloid Zschr.*, **89**, *pp.* 237–238, *Nov.*, 1939. *In German.*

1115. State of dispersion of gelatin in concentrated KCNS solutions. E. O. Kraemer. *J. Phys. Chem.*, **45**, *pp.* 660–670, *April*, 1941.—In order to study the nature and mechanism of the interaction between gelatin and agents which inhibit gelation of aqueous gelatin solution a preliminary investigation of the size, shape and structure, of the dissolved macromolecule, by a combination of sedimentation, diffusion and viscosity measurements, is reported, using KCNS as inhibiting agent. Data are tabulated and discussed, and results indicate that gelatin disperses as single molecules in concentrated KCNS solution as well as in dilute NaCl solution above the gelation temperature. The dissolved molecules are folded and coiled to about 1/5 of the extended length. N. M. B.

CRYSTAL STRUCTURE AND SPECIAL PROPERTIES.

1116. Statistical theory of binary alloys. I. Y. Takagi. *Proc. Phys.-Math. Soc., Japan*, **23**, *pp.* 44–65, *Jan.*, 1941.—The number of arrangements of atoms *A* and *B* on the lattice points, which have a given number of pairs of nearest neighbours of type *AA*, are derived from probability theory, and as a consequence the free-energy formulae are found explicitly. It is then shown (1) that the superlattice problems of the various lattice types and at arbitrary concentrations can be treated by the application of one simple and general method, (2) that the relation assumed as the basis of the quasi-chemical method can be obtained as the result of a purely mathematical process, and (3) how the results of Bethe, Bragg-Williams and others, may be derived from the free-energy formulae. H. H. Ho.

1117. Optical, spectrographic and radioactivity studies of zircon. J. H. Morgan and M. L. Auer. *Amer. J. Sci.*, **239**, *pp.* 305–311, *April*, 1941.—The variations in physical properties of Zr may be due to breakdown of the crystal lattice by the action of radioactive elements included at the time of crystal formation. It is suggested that the type of Zr present in a granite is governed by the concentration of U in the magma at the time of formation of the Zr crystals. Authors.

1118. Fractional crystallization. Mathematical analysis of fractional crystallization problems in *n*-component systems. H. J. Garber and A. W. Goodman. *J. Phys. Chem.*, **45**, *pp.* 573–588, *April*, 1941.—The quantitative effect of evaporating solvent from a solution at constant temperature is considered and it is assumed that the co-existent phases are in equilibrium and that the law of conservation of matter holds. A general analytical method is proposed for calculations involving fractional crystallization. For 4-component systems a suitable method involves vector algebra, but for a general system of *n* components ordinary algebra is used and the method assumes a form analogous to those for 4-component systems. Errors and difficulties are indicated. W. R. A.

1119. Inter-action of electrons in metals and insulators. C. W. UFFORD. *Phys. Rev.*, **59**, *pp.* 598–608, *April* 1, 1941.—The electrostatic energy of electrons in a lattice is calculated by the Rayleigh-Schrödinger perturbation method. This method gives a value which becomes logarithmically infinite for a metal. For an insulator, however, the gap in energy above the first occupied zone leads to a finite result. Numerical values are found for the 3 cases in which the gap is $\frac{1}{2}$ the width of the first zone, equal in width, and twice as wide. AUTHOR.

1120. Crystal lattice orientation of rolled magnesium. D. E. THOMAS. *Phil. Mag.*, **31**, *pp.* 425–431, *May*, 1941.—The crystal lattice orientation of rolled Mg is studied from evidence given by transmitted and reflected X-ray diffraction patterns. A departure from true fibre structure is indicated by the photographs, and an interpretation of it is offered. The interpretation also explains the difference between the angular separation of the radial reflections in the transmitted patterns and that of the planes producing them. AUTHOR.

1121. Orientation of Mo crystals deposited on NaCl. S. SHIRAI. *Proc. Phys.-Math. Soc., Japan*, **23**, *pp.* 12–18, *Jan.*, 1941.—The experiments here described investigate the orientation by electron diffraction of all Mo crystals in a thin film prepared by evaporation *in vacuo* on a heat-treated cleavage plane of the NaCl crystal. The NaCl crystals were prepared by slow cooling from the molten salt in an electric furnace. In all the orientations which Mo crystals can take on the NaCl cleavage plane a face diagonal of the Mo cube is parallel to an edge of the NaCl cube. Various orientations at different temperatures are described and discussed in detail. H. H. HO.

1122. Crystal lattice models based on close packing of spheres. A. L. PATTERSON. *Rev. Sci. Instrum.*, **12**, *pp.* 206–211, *April*, 1941.—The problem of the close packing of spheres is investigated exhaustively for the case in which the spheres occupy the lattice points of a space lattice. This type of packing can be realized in boxes with plane walls as suggested by Langmuir and Nelson [Abstr. 2887 (1940)]. It is shown that there are 15 types of packing which differ from one another either in symmetry or in the number of contacts a given sphere makes with its neighbours. In these 15 types 10 of the 14 Bravais lattices are represented. The use of lattice close packing as a basis for models of more complex structures is discussed. AUTHOR.

1123. Fibre structure in alkali metal wires. C. GORIA. *Kolloid Zschr.*, **89**, *pp.* 325–328, *Dec.*, 1939. *In German.*—X-ray spectrographic investigations of wires of K, Na and a compound of Ka and Rb, showed a partly disordered structure when the substances were rapidly cooled after having been melted. If the wires are slowly cooled an ordered fibrous structure is obtained with the direction [100]. If pressure was applied during the freezing process the direction was changed to [111], while under tension the fibres were orientated in the direction [110]. With the solid solution in the first case the formation of the fibres was more distinct than with the pure metals as the growth of the primary germs is not impaired by sudden changes in volume. As all the alkali metals have the same lattice structure and the same physical and mechanical properties, the results obtained are characteristic for all of them. The lattice structure is the same at ordinary temperatures as at very low temperatures. The results of the investigations agree with what is known about the connections between fibre structure and crystal lattice. R. N.

1124. The disperse structure of solid crystal systems and its thermodynamic basis. D. BALAREW. *Kolloid Zschr.*, **92**, *pp.* 179–182, *Aug.*, 1940. *In German.*—As a result of investigations on the dye absorption of more or less heated salt crystal systems it is concluded that the structure of these systems, being intergrain conglomerates, is transformed reversibly. The equilibrium point of the crystal system is shifted with changes in temperature. The experiments were carried out with CaF$_2$, CaCO$_3$ and BaCO$_3$, using tropeolin 000, Congo-red and hematoxylin as dyestuffs. [See Abstr. 4199 (1939]. R. N.

1125. Crystals and photons. C. V. RAMAN. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 1–8, *Jan.*, 1941. —The excitation of the optical modes of vibration of a crystal lattice by radiations incident on the crystal is discussed. The optical vibrations can be described as oscillations of the interpenetrating lattices in the crystal with respect to one another. They give rise to a periodic variation of the physical constants, e.g. electric dipole moment, optical polarizabilities, structure amplitudes, which influence the behaviour of radiation in various ranges of frequency in its passage through the crystal. The scattering of light or the reflection of X-rays with change of frequency appears as the result of the phase of the lattice vibrations varying from point to point in such a manner that the crystal is, in effect, an optically stratified medium giving a monochromatic reflection of the incident rays at the appropriate angle of incidence determined by the spacing of the stratifications and the wavelength of the incident radiation. AUTHOR.

*** 1126. Motor-driven ionization spectrometer.** M. E. JEFFERSON AND S. B. HENDRICKS. *Rev. Sci. Instrum.*, **12,** *pp.* 199–203, *April,* 1941.—In this instrument the co-axial rotation of chamber and crystal is accomplished on precision ball bearings in place of the usual conical bearing. The scales of the instrument are projected for ease in operation. A simple manual recorder is included. AUTHORS.

See also Abstract 1317.

DENSITY.

1127. Vapour density of iodine at high temperatures. M. L. PERLMAN AND G. K. ROLLEFSON. *J. Chem. Phys.*, **9,** *pp.* 362–369, *April,* 1941.—By measurement of *p.v.* products of I vapour at temperatures between 723° and 1 274°K. it was determined that the vapour in this region consists of diatomic molecules and atoms in equilibrium. No evidence was found for the existence of triatomic molecules. The heat of dissociation, calculated from the experimentally determined equilibrium constants and the known energy levels of the atom and the molecule, was found to be 35 514 ± 50 cal. AUTHORS.

1128. Density of aqueous solutions of KOH. G. AKERLOF AND P. BENDER. *J. Amer. Chem. Soc.*, **63,** *pp.* 1085–1088, *April,* 1941.

1129. Densities and refractive indices of unsaturated hydrocarbons. M. L. HUGGINS. *Kodak Res. Lab. Commun. No.* 778. *J. Amer. Chem. Soc.*, **63,** *pp.* 916–920, *April,* 1941.—The tables in this and the preceding paper [Abstr. 588 (1941)] show (1) that the previously used simple additivity relations for molal volume and molal refraction are not accurate within the usual differences between different experimental measurements, and (2) that such accuracy can be achieved for most of the compounds of interest by the use of slightly more complicated equations. The constants in the refraction equations deduced agree with the assumption that each bond contributes a characteristic amount to the total molal refraction, depending on the elements joined by the bond and on the numbers and kinds of other atoms attached to the two atoms joined by the bond in question. AUTHOR.

See also Abstract 1100.

DIFFUSION AND OSMOSIS.

*** 1130. Thermal diffusion in ternary liquid mixtures, particularly aqueous solutions containing ferrous chloride.** L. J. GILLESPIE AND S. BRECK. *J. Chem. Phys.*, **9,** *pp.* 370–374, *April,* 1941.—The accumulative arrangement of Clusius and Dickel for thermal diffusion was used to study the concentration changes at the extreme ends of the apparatus that occur in various mixtures, particularly solutions of 2 solutes in water. The apparatus gave reasonably reproducible results. AUTHORS.

ELASTICITY AND PLASTICITY.

1131. Statistic-kinetic theory, thermodynamics and biological significance of rubber-like elasticity. E. WOHLISCH. *Kolloid Zschr.*, **89,** *pp.* 239–269, *Nov.*, 1939. *In German.*—With a view to furnishing a better insight into the phenomena connected with the contraction of muscles the author gives a survey of investigations on the behaviour of rubber-like substances as concerns crystallization, thermo-elasticity and kinetic theory of elasticity based on the properties of highly polymerized substances. The analogies between rubber-like substances and genuine biological structures are pointed out. A Bibliography of 112 publications is given. R. N.

1132. Elasticity theory of finite displacements. II. R. KAPPUS. *Z. angew. Math. Mech.*, **19,** *pp.* 344–361, *Dec.*, 1939. *In German.*—The theory previously developed [Abstr. 615 (1940)] is applied to simple cases of torsion and bending of a bar when large displacements but small distortions are admitted. The application to stability problems is dealt with and the theory of indifferent elastic equilibrium is given. A system of linear homogeneous differential equations is obtained for the critical displacements. Equations are given and discussed for bar-, plate- and shell-shaped bodies, the effect of previous deformations being, as usual, neglected. The significance of the different terms of buckling is dealt with and the torsional buckling of a tube is discussed. Finally, a general derivation is given of the energetic indifference criterion and the Euler strut is treated according to this theory. R. N.

1133. Precise investigation of Hooke's law in primary elastic deformation. M. ICHINOSE. *Proc. Phys.-Math. Soc., Japan,* **23,** *pp.* 119–131, *Feb.*, 1941.—The author has shown that the relative difference between the kinetic and static moduli for bending of polycrystalline bars is nearly equal to the theoretical value of the difference between the adiabatic and isothermal moduli. Rectangular bars of soft steel, brass and copper, were tested by bending. These rested on ball-bearing rollers, and the deflection of the ends was measured optically. The loading was done (*a*) step by step, and (*b*) by finding the effect of each load separately. Secondary deformation appears rapidly during the first few minutes after loading or unloading in the case of copper. It is concluded that Hooke's law holds for primary elastic deformation, and that deviations from the law are due to secondary deformation. G. E. A.

1134. Round shells of uniform strength for constant inner and outer pressure. F. Tölke. *Z. angew. Math. Mech.*, **19,** *pp.* 338–343, *Dec.*, 1939. *In German.*—Excluding bending stresses the author derives the differential equations for round shells of constant thickness, starting from an element of the wall subjected to longitudinal and ring stresses only. The equations may be solved by Legendre's normal integrals of the first and second kind. The solution is given in parameter form and discussed. Tables and diagrams are given for the shape of the generating curves. The only closed form of shell of uniform strength is the sphere. Limiting forms are the cylinder and the hoop. R. N.

1135. Stress/strain curve for the atomic lattice of iron. S. L. Smith and W. A. Wood. *Proc. Roy. Soc. A*, **178,** *pp.* 93–106, *May* 9, 1941.—The changes in dimensions of the atomic lattice of tensile specimens are determined in the direction perpendicular to the applied stress and compared with the contraction in external dimensions which occurs in the same direction. It is shown that the lattice stress/strain curve, obtained by plotting the lateral change in lattice spacing against the tensile stress, exhibits 3 main characteristics. Up to the external yield point the lattice contraction is directly proportional to the applied stress. Beyond the yield point the lattice contraction slows down as the stress increases. Finally, at still higher stresses, the lattice tends to expand. A further set of experiments, in which cycles of stress are employed, show that when a stress greater than the yield stress is applied and then removed from a specimen the lattice is left with a permanent expansion which depends in a regular manner upon the value of the stress applied. It is concluded that beyond the external yield point the iron lattice undergoes 2 distinct modifications: (1) the lattice spacing tends to contract elastically, in conformity with the external elastic contraction exhibited by the specimen in the same direction; (2) the lattice tends to deform in a manner which leads to a superposed expansion of lattice spacing. Further experiments indicate that the permanent expansion of the lattice after loading occurs not only in the direction perpendicular to the applied stress but also in the direction of the stress; the permanent lattice deformation thus represents a decrease in density of the test specimen. Finally, the results of some experiments are recorded on the effect of temperature on the lattice expansion effect, and it is shown that recovery of the lattice can be produced by mild heat treatment at a temperature much lower than that required to renew the properties of the metal by recrystallization. Authors.

1136. Determination of the elastic modulus s_{13} of β-quartz. A.W. Lawson. *Phys. Rev.*, **59,** *pp.* 608–612, *April* 1, 1941.—The adiabatic Young's modulus of β-quartz along a direction at 45° to the optic axis has been measured as a function of temperature. These data, in conjunction with those of Atanasoff and Kammer, and of Perrier and de Mandrot, yield a value for the adiabatic elastic modulus s_{13} equal to $-\ 0{\cdot}226 \times 10^{-12}$ cm^2./dyne at 600°C. and indicate that the value reported by Osterberg and Cookson for c_{44} is inconsistent with the stability of β-quartz. Author.

1137. Plastic deformation of a circular cylinder and spherical waves in a plastic solid. Z. Sakadi. *Proc. Phys.-Math. Soc., Japan*, **23,** *pp.* 33–37, *Jan.*, 1941.—The differential equations for the plasto-elastic solid body obtained by Jeffreys [Abstr. 454 (1933)] and by Osida are solved for 2 simple cases, namely the torsion of a circular cylinder and the spherical dilational wave. The paper is entirely mathematical. H. H. Ho.

1138. Plastic behaviour of thin-walled pipes under internal pressure. R. Moufang. *Z. angew. Math. Mech.*, **20,** *pp.* 24–37, *Feb.*, 1940. *In German.*—Assuming that no forces act on the outer surface or the end surfaces and that deformations remain small and the material is incompressible, the differential equations are developed and solved for the stress components and deformations of the pipe subjected to static internal pressure. The investigations are based on the work of St. Venant and Mises and on Schmidt's law concerning strain-hardening. For the case of linear strain-hardening the first terms of a series are sufficient for determining the stresses and deformations. In this case and in the case of a sufficiently general form of strain-hardening function the stresses are, to a first approximation, independent of strain-hardening. R. N.

1139. Theory of the plastic properties of solids. F. Seitz and T. A. Read. *J. Appl. Phys.*, **12,** *pp.* 100–118, *Feb., and pp.* 170–186, *March*, 1941. —Various theories of the formation of slip-bands in single crystals subjected to external stress are discussed and, after dealing with Becker's and Smekal's theories, preference is given to the theory of dislocations. This latter theory assumes a type of imperfection of the crystal lattice capable of moving through the lattice without a given atom moving more than a single lattice distance, with the end result that the part of the crystal on one side of a plane is moved unit lattice distance relative to the other. The shearing stress to move the region of imperfection is about 1/1 000th that of the stress required to cause slip in an ideal lattice.

A study is made of the internal friction of single crystals, as represented by measurements of the decrement of amplitude vibrations, and shows that very small stresses are required to promote the growth of dislocations at room temperature. The theory is then applied to the problems of work-hardening, re-softening, the hardening effect of impurities and precipitation hardening. A. C. W.

1140. Velocity of longitudinal waves in cylindrical bars. D. Bancroft. *Phys. Rev.*, **59,** *pp.* 588–593, *April* 1, 1941.—The velocity of longitudinal waves in cylindrical bars may be expressed as the product of the velocity at infinite wavelength into a function of 2 variables : Poisson's ratio and the ratio of the dia. of the bar to the wavelength. This function is computed over the domain of the arguments which is of physical interest. Asymptotic values for the velocities at very short wavelengths are deduced, and the variation of the displacement as a function of the radius is discussed. It is found that a similar analysis can be applied to torsional and flexural waves. Author.

1141. Characteristic oscillations of pressed circular plates. F. A. Willers. *Z. angew. Math. Mech.*, **20,** *pp.* 37–44, *Feb.*, 1940. *In German.*—Starting from Hamilton's principle the author investigates the various conditions concerning boundary and transition states of oscillations of a strip of a plate. The fundamental frequency of a circular plate with elastic support in the centre is determined, the edge being subjected to forces acting in the middle plane. R. N.

1142. Transverse oscillations of the arched I-girder. K. Federhofer. *Z. angew. Math. Mech.*, **20,** *pp.* 13–23, *Feb.*, 1940. *In German.*—Previous investigations on circular arcs with circular or ring-shaped sections [Abstr. 5401 (1936)] are extended to the case of I cross-section. The theory of vibrations of flection and torsion is developed. The differential equation is derived and the frequency is calculated for the full free ring, taking into account the influence of vault resistance, torsional inertia and deformation of the flanges. The frequency equations are given for the symmetrical and counter-symmetrical natural vibrations of a girder fixed on both sides with any angle of opening. An approx. method is given for determining the smallest root of the frequency equation and hence the frequencies as dependent on the vault resistance for the usual sections of standard I-beams. R. N.

1143. Acoustical studies of the flutter of an airscrew. J. Obata, Y. Matumura, R. Kanayama and Y. Yosida. *Rep. Aero. Res. Inst., Tokyo, No.* 202, *pp.* 555–590, *Nov.*, 1940.—When airscrew flutter occurs, there is a sudden change in the nature and increase in the loudness of the sound made by the screw. It begins when the speed of the screw reaches a value depending on the make of the screw and is responsible for frequent airscrew failures. Five 3-bladed airscrews of Al alloy were tested, their natural modes of vibration in a non-rotating condition and when mounted on the shaft of an electric motor being determined. Of these modes 5 partials due to bending and 3 higher frequencies due to torsion were found, ranging from about 30 to about 900 per sec. It is found from the sound analyses that the modes of vibration constituting the flutter are the 3rd mode of bending (frequency 115), and the 1st and 2nd modes of torsional vibrational (315 and 590). The cause of breaking is attributed to the second torsional mode. The conclusion given in a previous report [Abstr. 505 (1940)], that the flutter sound is made up of sounds due to rotation, blade vibration and their combinational tones, is confirmed.

G. E. A.

1144. Mechanical behaviour of liquids under h.f. oscillations. I. Osida. *Proc. Phys.-Math. Soc., Japan*, **23,** *pp.* 18–27, *Jan.*, 1941.—The stress/strain relations are derived for a plasto-elastic body, i.e. a liquid which has dissipating shearing stress, and these are then applied to the longitudinal and lateral waves, from which change of velocity with frequency, namely dispersion and absorption, are obtained. The existence of transverse waves in a liquid is also deduced indirectly.

H. H. Ho.

1145. The problem of wave motion for the wedge of an angle. A. N. Lowan. *Phil. Mag.*, **31,** *pp.* 373–381, *May*, 1941.—[See Abstr. 2731 (1939)].

1146. Mechanical properties of celluloid as dependent on nitrocellulose and camphor. M. Wadano. *Kolloid Zschr.*, **92,** *pp.* 362–370, *Sept.*, 1940. *In German.*—Two kinds of particles exist in celluloid, the one, in the range poor in camphor, consisting mainly of nitrocellulose, the other, in the camphor-rich range, consisting of a camphor-nitrocellulose complex. Celluloid prepared from nitrocellulose of high viscosity and containing large particles has greater mechanical strength, higher coefficient of elasticity and greater total elongation, but less plastic elongation, than that prepared from nitrocellulose of small viscosity. The effect of the camphor on the change of the mechanical properties is greatest with celluloid prepared from medium nitrated nitrocellulose. It declines if the percentage of N deviates from 11%. When celluloid was prepared from 30% high-viscous and 70% low-viscous nitrocellulose, its properties, with exception of the coefficient of elasticity, were inferior to those of celluloid prepared from uniform nitrocellulose of equal viscosity. Celluloid in water of 80°C. and above becomes completely plastic. R. N.

1147. Intrinsic inelasticity of large plates. C. ZENER. *Phys. Rev.*, **59**, *pp.* 669–673, *April* 15, 1941.—A theory is developed for the reaction of plates to forces of such short duration that the waves reflected from the boundary may be neglected. It is found that the velocity of the point of application of the force is proportional to the force, and hence the total displacement is proportional to the impulse of the force. The theory is applied to the impact of spheres with large plates. The coefficient of restitution is obtained as a function of the parameters of the impact. Complete agreement is obtained with previous experiments. AUTHOR.

***1148. New instrument for rheological studies of plastic substances.** C. R. BAILEY. *Industr. Engng Chem.* (*Analytical Edition*), **13**, *pp.* 173–177, *March* 15, 1941.—The aims, details of construction, accessories and procedure, of a new instrument for the rheological studies of plastic substances are discussed. The instrument is to be regarded not as a fixed quantity invariable in make-up but as an embodiment of principles necessitated by the mechanical properties observable during the deformation of plastic materials. Essential mechanical parts are first described and then suitably modified forms of the instrument with accessories are dealt with which are necessary for control and research related to pectins, jellies, gelatins, oil-well drilling sands, ceramic slips, pharmaceutical gels, thermoplastics, and polymer-plastics, and in particular to the forces required in producing incipient flow or permanent deformation. The instrument, which has been used in studying the forces required to produce breakage of certain bentonite lyogels, embodies the torsion principle, and the sample is actually sheared, thus making measurement of ultimate strength within the sample possible, rather than of forces between interfaces. H. H. HO.

***1149. Measurement of flow properties with the Gardner mobilometer.** P. W. KINNEY. *Industr. Engng Chem.* (*Analytical Edition*), **13**, *pp.* 178–185, *March* 15, 1941.—The rheological properties of various plastic soft solids as reported by use of the mobilometer have never been stated in absolute units and, therefore, comparison with the results obtained with other instruments is not easy. It is now shown how the Gardner mobilometer has been calibrated to give results in absolute units and a comparison of data is presented for several materials measured with 3 different types of disc. The range of application in determining the viscosity of true liquids is 10^{-1} to 10^{4} poises. Precision to *ca.* 2% can be obtained if proper precautions, such as good machining of the working parts, are exercised and certain specified corrections are employed. To obtain the true value of the force overcoming the viscous or plastic resistance of the material, a buoyant-force correction must be subtracted from the weight producing the shear. The instrument can be calibrated with a standard liquid, so that the results can be given in absolute units by the equations: $\eta=\kappa\,(W-6\rho)t$, for a true liquid ; $1/t=\mu(KF-Kf)$, for a plastic soft solid, when F = force per unit area, η = viscosity, t = time for constant amount of shear, K is an instrumental constant, μ = mobility (cm^2./dyne.sec.), and f is related to yield value due to structure. H. H. HO.

See also Abstract 1108.

GRAVITATION.

***1150. Galitzin-type gravity meter.** G. I. WELCH. *Rev. Sci. Instrum.*, **12**, *pp.* 179–182, *April*, 1941.—The general requirements involved in the design of a gravity meter are outlined. The construction and characteristics of a meter developed by the author are discussed. The probable error of a single reading of the instrument when used in the field is 0·06 milligal. [6×10^{-5} cm./sec^2.]. AUTHOR.

HYDRODYNAMICS AND AERODYNAMICS.

1151. Transition from subsonic to supersonic speeds in nozzles. H. GÖRTLER. *Z. angew. Math. Mech.*, **19**, *pp.* 325–337, *Dec.*, 1939. *In German.*—An analytical solution of the problem is given forming a compromise between the unsymmetrical solution of Meyer and the symmetrical solution of Taylor, at least for the immediate neighbourhood of the narrowest section of the nozzle. The results of the solution agree with the experimental results of Stanton. The slow convergence of the series used leads to the assumption that, at the range immediately behind the narrowest section, a compression impact develops. This assumption is supported by a more general theorem on compressible flow. A proof is given for this theorem in the 2-dimensional case and in the rotational symmetrical case in space. By the use of this theorem flows may be constructed in which, under different gradients of speed, the local speed of sound may be reached or transgressed. R. N.

1152. Studies on the subsonic flow of a compressible fluid past an elliptic cylinder. S. TOMOTIKA AND K. TAMADA. *Rep. Aero. Res. Inst., Tokyo, No.* 201, *pp.* 477–551, *Nov.*, 1940.—The assumption that air behaves like an incompressible fluid ceases to be valid when the speed of a solid body through air approaches that of sound. A survey of previous results is given, including Taylor and Sharman's conclusion that, for a circular cylinder, convergence fails when the velocity of the undisturbed flow is between 0·4 and 0·5 that of sound [Abstr. 382 (1929)]. The compressibility burble at the breakdown of irrotational flow occurs when the Mach number, $M = U/c_0$, exceeds a certain critical value, U being the undisturbed velocity and c_0 the velocity of sound. The authors have investigated the irrotational subsonic flow of a compressible fluid past an elliptic cylinder placed at an arbitrary inclination to the direction of undisturbed flow, and the critical Mach number is calculated for various elliptic cylinders with different thickness ratios, t, for angles of attack of 5° and 10°. When the angle of attack takes any value different from 0° and 90°, the curve of the critical Mach number plotted against t has a max. at a definite value of t. The moment of the fluid pressures on the surface of the elliptic cylinder, with reference to the centre of the ellipse, has also been calculated. G. E. A.

1153. Motion of a solid through an infinite liquid under no forces. H. D. URSELL. *Proc. Camb. Phil. Soc.*, **37**, *pp.* 150–167, *April*, 1941.—A solid moving in an infinite liquid under no force is capable of steady translational motion in any one of 3 mutually perpendicular directions. The usual statement that only 1 of these directions is stable is shown to be untrue, and the conditions of stability are enunciated. W. A. R.

1154. Flow of gases in natural-draught furnaces. E. J. GOODING AND M. W. THRING. *J. Soc. Glass Technol.*, **25**, *pp.* 21–85(*T*), *Feb.*, 1941.—A method of measuring the aerodynamic resistances and buoyancies in a glass-tank furnace system is described, and the results obtained on 2 such furnaces are discussed. Static pressure measurements were made at various points throughout the system. Temperature determinations were made at various points in the regenerators and uptakes, using a suction pyrometer and a rare-metal thermocouple. Differential pressure measurements were also obtained vertically across the regenerators. The results are expressed in diagrams showing the pressure variation through the furnace system. From the temperature measurements the stack effects in the regenerators are calculated and the results compared with the measured pressure differentials. It is shown that the resistance to flow through the regenerators is negligible. In a similar manner the buoyancy effects through the ports are calculated, and by subtraction from the measured pressure values the port resistances are obtained in pressure units. The second part deals with methods of measuring the distribution of flow within the regenerator and the sub-division of gaseous flow through the 4 ports leading from the regenerator to the furnace. From these measurements it is shown that the buoyancy effect has a predominating influence in the regenerators, the momentum being subsidiary and the regenerator resistance negligible. Deductions are made with regard to flow in the gas and air regenerators and uptakes, and for waste gases. AUTHORS.

1155. Relaxation methods applied to engineering problems. VII. Problems relating to the percolation of fluids through porous materials. F. S. SHAW AND R. V. SOUTHWELL. *Proc. Roy. Soc. A*, **178**, *pp.* 1–17, *May* 9, 1941.—The accepted theory of percolation of fluids through porous materials (which is based on Darcy's law of resistance) indicates that the velocities can be calculated from a velocity potential which, in 2-dimensional motion, is plane-harmonic within the fluid field. The associated stream function, and the fluid pressure, are also plane-harmonic, so in cases where all boundaries are known their determination is an ordinary problem in plane-potential theory. But in cases where a free surface exists (as in the percolation of water through earth dams) its shape is not known *a priori*, consequently orthodox methods cannot be applied. The relaxation method developed in earlier papers [Abstr. 1997 (1940)] is shown to be applicable without special assumptions and to yield results of more than sufficient accuracy. Three typical examples are treated, the third involving refraction of the lines of flow and pressure at the junction of 2 materials of different porosity. AUTHORS.

1156. Extension of the differential equations for an incompressible viscous fluid. Z. SAKADI. *Proc. Phys.-Math. Soc., Japan*, **23**, *pp.* 27–33, *Jan.*, 1941.—This entirely mathematical paper deals with the equations for the incompressible viscous fluid and with the special cases of laminar flow and circular motion. H. H. HO.

1157. Laminar initial flow of a liquid on a rotating disc when the state of rotation is suddenly changed. K. H. THIRIOT. *Z. angew. Math. Mech.*, **20**, *pp.* 1–13, *Feb.*, 1940. *In German.*—The author investigates the phenomena in the boundary layer of a liquid on a plane rotating disc, especially when suddenly starting or stopping the rotation, [see Abstr. 3523 (1934)]. For the non-stationary problem the Navier-Stokes differential equation is integrated by an approximation method due to Blasius. The resulting speed functions are tabulated and represented in graphs. The lines of flow are logarithmic spirals the slopes of which are calculated for different heights of the layer above the rotating disc. Experiments were carried out and cinematographic pictures were taken of the water coloured with $KMnO_4$ crystals. Theoretical and experimental results are in good agreement. R. N.

MATHEMATICAL METHODS AND THEORY OF MEASUREMENTS.

1158. Two aids to the use of logarithmic chart paper. A. W. SWAN. *Engineer, Lond.*, **171,** *pp.* 290–291, *May* 2, 1941.—Referring particularly to the plotting of quantities to a logarithmic scale on a uniform base (e.g. cost, monthly) using semi-logarithmic paper, equal slopes represent equal rates of increase or decrease, irrespective of basic amount ; this is optically more informative than if a uniform ordinate scale is used. To measure ratio and percentage where 2 such graphs A and B are presented, a transparent scale marked logarithmically from 1 to 100 may be used. Placed over any common ordinate, if A lies above B, the ratio of A to B is found where the A graph crosses the scale, the unit index of which registers with the B graph. Alternatively, if the 100 index of the scale registers with the A graph, the percentage of B to A is indicated. A second device resembles a transparent protractor ; the angle lines are scaled in percentage gain or loss. This must be used in conjunction with an appropriate (uniform) base scale. G. F. F.

1159. Single sampling and double sampling inspection tables. H. F. DODGE AND H. G. ROMIG. *Bell Syst. Tech. J.*, **20,** *pp.* 1–61, *Jan.*, 1941.—The problem considered is the inspection of manufactured articles, submitted in lots, so that (*a*) the consumer is protected by limiting the chance of his receiving a lot containing more than a prescribed percentage of defectives (lot quantity protection) or by specifying the average percentage of defectives after inspection (average outgoing quality limit), and (*b*) the amount of inspection is reduced to a minimum. In single sampling the decision to accept the lot or inspect every member of the lot is determined by whether the number of defectives in the sample exceeds a certain number c. In double sampling a second sample is taken if the number of defectives in the first sample lies in a certain doubtful range c_1 to c_2. It is assumed that the average percentage of defectives turned out by the manufacturing process (process average) is known approximately. The single sampling tables give, for various process averages and lot numbers, the required size of sample and the number c to ensure various degrees of consumer protection with the min. of inspection. For double sampling the sizes of the first and second samples and the values of c_1 and c_2 are tabulated. In the important practical range double sampling leads to a saving of 10 to 50% in inspection time, as compared with single sampling. W. S. S.

1160. Logarithm of Bessel functions with real positive argument. E. BRIXY. *Z. angew. Math. Mech.*, **19,** *pp.* 372–379, *Dec.*, 1939. *In German.*

1161. Thoughts on statistical inference. W. E. DEMING. *J. Wash. Acad. Sci.*, **31,** *pp.* 85–93, *March* 15, 1941.

1162. Method of successive approximations for the solution of boundary layer equations. J. H. PRESTON. *Phil. Mag.*, **31,** *pp.* 452–465, *June*, 1941.—The iteration method [Abstr. 4781 (1938)] has been extended to cases of boundary layer flow with experimental pressures. The probable presence of a singularity at the break-away point causes the method to break down if a high degree of accuracy is required. AUTHOR.

1163. On a class of 2-dimensional distributions. M. P. GEPPERT. *Z. angew. Math. Mech.*, **20,** *pp.* 45–49, *Feb.*, 1940. *In German.*—With the help of Laplace's function the author shows the distributions of the form $f(x,y) = f(ax^2 + 2bxy + cy^2)$ to be the only ones in 2 variables preserving the linearity of regression in case of any rotation of the system of co-ordinates. This theorem may be literally extended to any linear and non-singular transformation of the variables. AUTHOR.

1164. Operational analysis of the diffraction grating. R. C. SPENCER. *J. Opt. Soc. Amer.*, **31,** *p.* 234, *March*, 1941.—Operational analysis is used to express the formula for the Fraunhofer diffraction pattern for a grating of N slits in terms of that for a single slit. AUTHOR.

1165. Chart for transferring spherical co-ordinates. F. BENFORD AND J. E. BOCK. *J. Opt. Soc. Amer.*, **31,** *pp.* 239–243, *March*, 1941.

1166. Tables of complete elliptic integrals. C. HEUMAN. *J. Math. Phys.*, **20,** *pp.* 127–206, *April*, 1941.

MECHANICS, CLASSICAL.

1167. Interpolation method for calculating flight trajectories of projectiles and their changes by varying the fundamental ballistic quantities. H. ATHEN. *Z. angew. Math. Mech.*, **19,** *pp.* 361–371, *Dec.*, 1939. *In German.*—The author shows how the calculations based on Popoff's theory may be simplified if 2 or 3 trajectories are known. As co-ordinate axes the direction of initial velocity and the vertical are chosen. The differential equations are given in parameter form, and the parameter may be represented by a rapidly converging power series, as holomorphous functions are involved. The effect of changes in the fundamental ballistic quantities, e.g. initial velocity, ballistic coefficient, changes in air density with varying height, etc., may be fairly easily evaluated. The max. error is estimated and numerical examples are given. R. N.

MECHANICS, QUANTUM.

1168. Ethane-ethylene-hydrogen equilibrium. E. A. Guggenheim. *Trans. Faraday Soc.*, **37**, *pp.* 271–273, *May*, 1941.—The calculations for the ethane-ethylene-hydrogen equilibrium recently published [Abstr. 335 (1941)] have been revised in view of a more recent assignment of the normal modes of ethylene. The result is a decrease of 4% in the calculated values of K_p throughout the experimental temperature range 673°K. to 973°K.
Author.

1169. Energy and wavelength maxima in Fermi-Dirac and Bose-Einstein distributions. A. G. Chowdri and B. N. Singh. *Indian Journ. Phys.*, **14**, *pp.* 387–391, *Oct.*, 1940.—The energy of the photons in a Fermi-Dirac and in a Bose-Einstein distribution, which corresponds to Wien's displacement law, is discussed. The max. of the energy (per unit volume) is investigated in both cases, the energy being regarded (1) as a function of the energy-range and (2) as a function of the photonic wavelength. The max. is determined by graphical methods, values being given for the relativistic and non-relativistic cases. G. C. McV.

RELATIVITY AND ETHER.

1170. Eclipses of binaries, velocity of light and relativity theories. G. Tiercy. *Arch. Sci. Phys. Nat.*, **23**, *pp.* 5–24, *Jan.–Feb.*, 1941. *In French.*—The hasty conclusion that the velocity of propagation of light was independent of the movement of the source has often been derived from double-star observations and particularly from the eclipses of stars. It is now shown from an examination of data furnished by a study of Doppler phenomena that this conclusion is not justified. For this purpose the isotropic relativity theory of Einstein is replaced by a non-isotropic theory of propagation in which the postulate of the invariance of the velocity of light is rejected. This replacement is accomplished without renunciation of the idea of classical space or of universal astronomical time and, in consequence, without the introduction of useless artifices. H. H. Ho.

SOLUTION.

See Abstract 1347.

SURFACE PROPERTIES.

1171. Ageing of surfaces of aqueous solutions of egg albumin. E. A. Hauser and L. E. Swearingen. *J. Phys. Chem.*, **45**, *pp.* 644–659, *April*, 1941.—The pendant-drop camera method has been used to examine the surface tension of aqueous solutions of egg albumin. Solutions containing from 0·005% to 2% of albumin tend toward the same limiting surface-tension values, after extensive ageing; solutions with higher or lower albumin content approach different limiting surface-tension values. The formation of secondary multilayers under the primary surface film is thought to be responsible for the prolonged ageing effect observed. The albumin concentration of the solution was found to have a marked effect on the surface tension of freshly formed surfaces, with diminishing effects as the surfaces become more completely aged. The *p*H of the solution and the degree of surface ageing are found to have considerable effect on the surface tension of 0·005% solutions. Surfaces at all ages show a min. surface tension in the iso-electric zone, with higher values on either side. A max. at *p*H 8·5 appears in the slightly aged samples. With longer ageing this max. disappears and there is an increase in surface tension, starting at the iso-electric zone and continuing through the *p*H range on the alkaline side. A sharp max. develops in the acid range at *p*H 2·5. Flask ageing for 56 hr. has little effect. Mechanical agitation produces incipient coagulation of a large portion of the albumin present. Heating for 3 hr. at 60°C. produces a small amount of incipient coagulation. Authors.

***1172. Measurement of boundary tension by the pendant-drop method. I. The aliphatic alcohols.** G. W. Smith and L. V. Sorg. *J. Phys. Chem.*, **45**, *pp.* 671–681, *April*, 1941.—Suitable equipment for obtaining photographic profiles of pendant drops is described. The method has been calibrated for accuracy by making measurements of surface tension on highly purified benzene, toluene, carbon tetrachloride and water. Measurements were carried out on normal aliphatic alcohols from methyl alcohol to lauryl alcohol and on all the readily obtainable isomers below hexyl alcohol. The data are presented and discussed from the viewpoint of the influence of the number of C atoms and of configuration. Authors.

***1173. Studies of surface properties by the light scattering of deposited liquid films.** V. J. Schaefer. *J. Phys. Chem.*, **45**, *pp.* 681–701, *April*, 1941.—A method is described for applying a very thin uniform layer of oil or other liquid film to the surface of a solid. Properties characteristic of the outer layer of molecules comprising the surface produce a distribution of the applied liquid in specific ways, depending on the oleophobic or hydrophobic nature of the surface, combined with such properties as degree of smoothness, homogeneity and surface area. The technique demonstrates surface properties which under ordinary conditions are quite invisible. Optical means for obtaining a quantitative measurement of the amount of light scattered by the treated surface is described, and the results of measurements of several types of molecular surfaces are given. A built-up multi-layer of acid barium stearate (*Y*-type) shows a periodic max. and min. in small-angle light scattering at thickness increments of 16 mono-layers. A small trace of copper in the water is shown to produce a large effect on the surface properties of the built-up film. The occurrence of an alternation in surface properties with each single successive *X*-type layer of Ca or Ba stearate is demonstrated, and the max. and min. of small-angle scattering are found to parallel the change in contact angle of large drops placed on the surface. The reasons for the observed differences in light scattering by liquid-coated surfaces are discussed, and the apparent mechanisms responsible are described. AUTHOR.

1174. Permeability in mono-layers. F. SEBBA AND E. K. RIDEAL. *Trans. Faraday Soc.*, **37,** *pp.* 273–278, *May*, 1941.—The permeabilities of a number of mono-layers to water vapour were examined in the evaporant. Protein and tanned protein mono-layers are freely permeable. The complex cetyl alcohol sodium cetyl sulphate film has a permeability similar to that of a cetyl alcohol mono-layer. Ethyl stearate and the esters are very much less permeable than stearic acid. A mixed film of eicosoic acid and docosanol is more permeable than films of either component. The evaporation of ammonia is retarded by mono-layers and the retardations effected do not run parallel with the retardations of the passage of water vapour. Mono-layers retard the evaporation of a 5% alcohol solution and differences due to the inclusion of the spreading fluid, especially benzene, in the mono-layer are observed. The retardations in evaporation of alcohol and water from the solution do not appear to be identical, some evidence for selectivity being observed. [See Abstr. 1012 (1940)].

1175. Electron diffraction study of the corroded state of metals. S. YAMAGUCHI. *Sci. Pap. Inst. Phys. Chem. Res., Tokyo, No.* 1009, *pp.* 204–209, *Feb.*, 1941.—[See Abstr. 346 (1941)]. Corrosion in the presence of the Cl^- ion was studied by electron diffraction to elucidate the influence of this ion on the reaction between Ca or Na and pure water and thereby to throw light on the mechanism of the remarkable corrosion of Mg by chloride solutions. In the case of Ca the CaO crystals formed were all oriented regularly as if they were polished along or beaten in a constant direction, and this is ascribed to the catalytic effect of the Cl^- ions in the reaction between the metal and water. Similar action was not observed for Na owing to the great velocity of reaction. The protective film for Mg is composed of large crystals of $Mg(OH)_2$ and MgO, and the previous conclusion, that the faster the reaction velocity the larger the crystals produced, is confirmed. H. H. HO.

See also Abstract 1095.

VISCOSITY AND FRICTION.

1176. Asymptotic solution of Southwell and Squire ; modification of Oseen's equations. J. H. PRESTON. *Phil. Mag.*, **31,** *pp.* 413–424, *May*, 1941.—The asymptotic solution of Southwell and Squire's equations is obtained directly from their original integral equation. This is found to lead to the same results as a simplified boundary-layer theory developed by Burgers and to give the same position for break-away as the outer solution first approximation of an entirely different method developed by Karmán and Millikan for the solution of the boundary-layer equations. The results are in qualitative agreement with experiment, thus bearing out the remark of Southwell and Squire—that their modification to Oseen's equation should give an indication of the changes of flow pattern with Reynolds number, differing but little from Oseen's approximation at low Reynolds numbers. The solutions are applied to the calculation of skin friction of elliptic cylinders. In the limiting cases of the plate and circle the results agree with those already obtained by Piercy and Winny and by Burgers. AUTHOR.

1177. New determination of the viscosity of air by the rotating-cylinder method. G. KELLSTRÖM. *Phil. Mag.*, **31,** *pp.* 466–470, *June*, 1941.—Houston [Abstr. 4871 (1937)] has drawn attention to 2 corrections to the simple theory of the rotating-cylinder method, which have not been considered in earlier determinations of η by this method [Abstr. 1557 (1937)]—the end-correction to the length of the inner cylinder and the correction for the influence of the air on the effective moment of inertia of the inner cylinder. In the present paper the influence of these corrections on the writer's earlier η-value is calculated. AUTHOR.

1178. Viscosity of cellulose and its nitrate in dilute solution. S. M. NEALE AND R. WAITE. *Trans. Faraday Soc.*, **37,** *pp.* 261–271, *May*, 1941. —A study is made of the viscosities of dilute solutions of cellulose in cuprammonium solvents of varying Cu and NH_3 contents, and of solutions of the derived nitrate in various organic solvents. All except the most dilute solutions showed anomalous flow, the apparent viscosity decreasing with the shearing stress applied. Neither the log of the viscosity nor the sp. viscosity was found proportional to the concentration, and the value $\lim_{c \to 0} \eta_{sp}/c$ varied with the solvent. The degree of polymerization of the sample used, deduced from the viscosity, indicated a molecule containing 2000–3000 glucose residues. AUTHORS.

See also Abstracts 1149, 1333.

ASTRONOMY AND ASTROPHYSICS.

COMETS AND METEORS.

1179. Methods of determining Ni and Co in meteoric Fe. E. P. Henderson. *Amer. J. Sci.*, **239**, *pp.* 372–378, *May*, 1941.—Different analyses on the same iron meteorite frequently show a wide variation in composition. This may be due to the methods of sampling the meteorite or to the method followed. Fe should always be determined volumetrically ; Ni can be precipitated by dimethylglyoxime in the presence of Fe by holding the Fe in solution with tartaric acid ; Ni and Fe can be separated by 4 precipitations of Fe with strong ammonia and the Ni determined in the combined filtrates after the excess ammonium salts are expelled and Co is not as completely separated from the Fe as is Ni by the strong ammonia. A high degree of accuracy is not claimed for this method. Author.

1180. Heights and velocities of meteors. H. C. Plummer. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 76–83, 1941.—The relative merits of the arithmetic and the harmonic mean for the heights of meteors are discussed. The seasonal variation in the heights of meteors at 3 points in their observed paths is submitted to harmonic analysis. The corresponding number of observations is analysed in the same way. It is found that the monthly numbers are closely correlated with the corresponding mean heights. When the general monthly rate of meteors is analysed the result does not differ greatly from that obtained after the shower meteors have been excluded. This persistence in the distribution of meteoric nodes suggests a pervading structure of the whole system. The distribution of meteoric velocities is considered. The occurrence of hyperbolic velocities is inferred from Denning's determinations no less than from recent observations. Stress is laid on the value and importance of the visual observation of meteors. Author.

1181. Ionization by meteors. J. A. Pierce. *Phys. Rev.*, **59**, *pp.* 625–626, *April* 15, 1941.—Experimental evidence of atmospheric ionization by meteoric bombardment is presented and may be useful in studying diffusion and recombination in the upper atmosphere and in counting meteors in the daytime or in cloudy weather. Author.

PLANETS.

1182. Charting the planetary phenomena. S. Harris. *J. Roy. Astr. Soc. Can.*, **35**, *pp.* 169–172, *April*, 1941.—The construction is described of a chart showing simultaneously many of the planetary and lunar phenomena of a given year. The method is to plot the R.A.s of the Sun, Moon and planets against epoch. The solar line is then the locus of conjunctions of the other bodies with the Sun ; and lines parallel to it, 6 and 12 hrs. away, are loci of quadratures and oppositions respectively. A chart for 1941 is reproduced. A. Hu.

1183. Observation at Sydney Observatory of the transit of Mercury, 1940 November, 11-12. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *p.* 102, 1941.

1184. Observation of the transit of Mercury on 1940, November 11-12. D. W. N. Stibbs. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *p.* 103, 1941.

1185. Remarkable spot on Jupiter. B. M. Peek. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 70–75, 1941. —The longitudes of a dusky spot at the N. edge of Jupiter's S. Temperate Belt, derived from 25 observations of its passage across the central meridian, are plotted against the time. It is found that a damped harmonic oscillation in longitude is very closely represented by the observations. The suggestion is made that the spot observed at the surface was associated with the presence of a solid body, deep down in the fluid atmosphere, which was performing a vertical oscillation about the level at which it would have floated in equilibrium. On this hypothesis the density gradient and the compressibility of the atmosphere at the equilibrium level are calculated ; but the figure derived for the latter is smaller by a factor of 10^7 than the lowest values that have yet been found for fluids in the laboratory. Author.

STARS.

1186. Stellar parallaxes determined photographically at the Cape Observatory (twelfth list). *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 104–109, 1941.

1187. Occultations observed at the Royal Observatory, Cape of Good Hope, in 1940. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 110-112, 1941.

1188. Physical relationship between emission-line stars of early type. C. S. Beals. *Observatory*, **64**, *pp.* 42–47, *May*, 1941.—Attention is drawn to certain stars which combine in the same spectrum the characteristics of Be spectra, of P Cygni-type spectra, and sometimes also of α Cygni-type spectra. A tentative mechanism is proposed which interprets the general lines of the spectroscopic observations and suggests that the Be stars and the recently discovered "super-shell" stars exhibit the early stages of physical characteristics which are seen fully developed in supergiants of the α Cygni and P Cygni types. A. Hu.

1189. Notes on binary stars. IV–V. T. E. Sterne. *Proc. Nat. Acad. Sci., Wash.*, **27**, *pp.* 168–181, *March*, 1941.—[See Abstr. 988

(1941)]. In the first paper the author points out that the axial rotation of a component of a spectroscopic binary combines with its tidal distortion and with its darkening to influence its observed radial velocity. The amount of the contribution to the radial velocity is computed for all stellar models. It is found that, even when an orbit is really circular, the contribution is usually such as to lead, when not allowed for, to a non-vanishing spectroscopic eccentricity and to a longitude of periastron of 90°. The author next deals with the difficulty that the usual form of least-squares solution is unsuited to orbits of very small eccentricity. Two forms of solution are presented which enable this difficulty to be avoided while retaining the advantages of least squares. The first form is suitable for all orbits except those with very small eccentricity. The second form is particularly suitable for the remainder and is unusually simple. A. Hu.

1190. Photographic survey of galactic clusters. II. N.G.C. 663, 659, 654, 559, Tr. 1, Appendix to N.G.C. 581. G. Alter. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 89–101, 1941.—The paper extends, in available cases, the method described in an earlier paper [Abstr. 1758 (1940)] by the use of spectral classification to determine a possible colour excess. A comparison of colour excesses, published by Zug, with background star densities, published by Raab, for the same 15 clusters seems to indicate a relation between these two quantities. Irregularity in the range of the distance modulus $(m - M)$ of cluster stars indicates the presence of absorption. Five clusters in a small Cassiopeia region are investigated. N.G.C. 663 is shown to be obscured, having a remarkable colour excess. A comparison with earlier investigations of this cluster is given, and the differences are, as far as possible, explained. N.G.C. 654 is supposed to be covered by the same obscuring cloud as the foregoing cluster, and a suitable correction is applied. N.G.C. 659 shows a notable distribution of distance moduli, thus giving two possibilities of explanation : either the clustering in the area is the result of a superimposition of 2 different widely separated clusters, or, more probably, it represents one cluster with a group of giants. Finally, the results are given of N.G.C. 559 and a cluster, first mentioned in Trumpler's catalogue, as Tr. 1. Author.

1191. Limits of uniform galactic absorption. G. Alter. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 84–88, 1941.—The paper shows that the absorption conditions in a uniform and continuous absorbing galactic layer can be determined by the observed relation between colour index and absolute magnitude, and limits are found for the absorption coefficients. An assumption regarding the proportionality between the photographic and the selective absorption coefficient restricts these limits further. Suggestions are made for the determination of the actual coefficients. Author.

See also Abstract 1362.

SUN.

1192. Problems of the motions of solar prominences. M. A. Ellison. *Nature*, *Lond.*, **147**, *pp.* 662–664, *May* 31, 1941.—The author reviews Pettit's work, culminating in his 2 empirical laws, and the improvements in instrumental technique introduced by Lyot and by McMath. He concludes that automatic recording of radial velocities is badly needed so that 3-dimensional pictures can be obtained. Recent theoretical work is shown to explain only some aspects of the observed results. A. Hu.

1193. Motion of gases in the Sun's atmosphere. I. Mechanism of formation of solar dark markings. A. K. Das. *Indian Journ. Phys.*, **14**, *pp.* 369–386, *Oct.*, 1940.—The dynamics of a mass of gas ejected from the body of the Sun is studied and the equations of motion of a material particle in a system of rotating co-ordinates with origin on the surface of the Sun are derived for 2 cases, (1) when the particle is ejected from the photospheric or any other level where the angular velocity of rotation is the same as that observed on the Sun's surface, and (2) when the particle is ejected from a level where the angular velocity is higher than the angular velocity at the surface. The set of equations for case (2) are shown to be applicable to a mass of gas ejected from the interior of the Sun, that is from levels below the photosphere. Many of the unexplained features of dark markings can also be quantitatively explained on the basis of the above equations. Author.

1194. Convection in the outer layers of the Sun. R. van der R. Woolley. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 52–65, 1941.—This paper is mainly concerned with the effect of convection on the darkening of the limb of the Sun. It also gives limits to the amount of convection possible. An empirical analysis is made of the amount of convection required to bring about agreement between theory and Abbot's observations of limb darkening (integrated by Milne), assuming the solar atmosphere to be grey. A theory of convection, from which it is possible to deduce max. values for convection and corresponding min. velocities for the convection streams, is given. The effect of the max. convection on the darkening of the limb is found to be less than 1 : 1 000, and the empirical convection is found to require velocities which would blur the Fraunhofer lines. An Appendix discusses the effect of the Fraunhofer lines on the darkening of the limb. AUTHOR.

1195. Coronal observations at eclipse of 1940, October 1. C. W. ALLEN. *Observatory*, **64**, *pp.* 48–50, *May*, 1941.—Observations were made with a polarization camera and a coronal spectrograph at Calvinia, S. Africa. Preliminary measures indicate 40% polarization for the red light of the outer corona and 44% for the blue. Any wavelength shift in the coronal Fraunhofer lines is difficult to detect and appears to be less than the 27 km./sec. previously found. As the results stand at present there is good support for Grotrian's suggestion that the coronal light is produced by the scattering of sunlight by dust and electrons. A. HU.

1196. Birth distribution of sunspots on the Sun's disc. G. H. A. ARCHENHOLD. *Mon. Not. Roy. Astr. Soc.*, **101**, 2, *pp.* 66–69, 1941.—The distribution of the first appearances of sunspots as a function of the longitude from the central meridian is dependent on the curve of visibility, on the form and number of the life-curves of spots and on the interval in which the observations of the Sun are made. By making reasonable assumptions as regards these 3 factors, the observed distribution is represented theoretically by the use of a method described in the paper. AUTHOR.

1197. Notes on the foreshortening of sunspots. G. H. A. ARCHENHOLD. *Observatory*, **64**, *pp.* 50–55, *May*, 1941.—The author examines how the apparent position of the centre of an unsymmetrical sunspot group is affected by its position on the disc. Physical foreshortening causes an apparent shift towards the central meridian, the amount depending on the size and position of the spots in the group. An explanation of the asymmetry (as regards the central meridian) of this apparent proper motion is suggested, and the bearing of the effect on the observed asymmetrical distribution of groups on the disc is pointed out. The surprisingly high correlation between Wolf's relative numbers and measured areas is explained by the fact that foreshortening introduces an unintentional allowance for spot areas in the calculation of the relative numbers. A. HU.

1198. The Sun's magnetic field and the diurnal and seasonal variations in cosmic-ray intensity. L. JÁNOSSY AND P. LOCKETT. *Proc. Roy. Soc. A*, **178**, *pp.* 52–60, *May* 9, 1941.—The diurnal and seasonal variations in the vertical cosmic-ray intensity, produced by a solar magnetic dipole field, are calculated at latitudes 0 and 45°, and compared with observed data. It appears that the diurnal variation at latitude 45° can be largely accounted for by assuming the existence of a solar dipole of moment $1{\cdot}1 \times 10^{34}$ gauss cm.^{3}, a value which is consistent with observational evidence. The diurnal variation at the equator, however, cannot be explained by the hypothesis of a solar magnetic dipole field. The seasonal variation in intensity inferred from the above value for the solar dipole moment is of the same order of magnitude as the observational variation but shows a phase discrepancy of 2 months. AUTHORS.

1199. Persistent solar-rotation period of 27·26 days. H. H. CLAYTON. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 71–77, *March*, 1941.—This paper attempts to show: (1) The persistence of sunspot-outbreaks in the same longitudes of the Sun for long intervals of time and the mean length of the solar-rotation period derived therefrom; (2) that the solar-rotation period, as shown by the spots, varies in length with the mean latitude of the spots. The period is longest after sunspot min. when the spots are in high latitudes and shortest a year or two before the next min. when the spots are in low latitudes, in agreement with findings of Bartels, using other methods. The mean length is 27·26 days, slightly shorter than the value 27·28 days found by Carrington, and the period seems to return in the same phase in the same part of the 11-year period in the case of data here used; (3) there is also evidence suggesting solar periods differing from 27 days. AUTHOR.

ZODIACAL LIGHT AND GEGENSCHEIN.

1200. Observing of aurorae. R. J. NORTHCOTT. *J. Roy. Astr. Soc. Can.*, **35**, *pp.* 173–176, *April*, 1941.—Gives some instructions and rules for making useful observations. ED.

GEOPHYSICS.

GEOPHYSICS, APPLIED.

1201. Seismic velocity distributions in the testing basins of California. W. HAFNER. *Bull. Seism. Soc. Amer.*, **30**, *pp.* 309–326, *Oct.*, 1940. The analysis of time/distance curves of seismic refraction profiles or of continuous reflections are of limited practical use, but direct observations of well velocity surveys give time/depth functions which are applicable to all depths and can be used for co-operative surveys. The method is described and the sources of error are examined. The curves obtained are vertical time/depth functions of velocity and form broadly averaged approximations. The characteristic features are shown in diagrams. It was established that the velocity increased gradually with depth and the rate of increase is approx. linear. The lateral variations are frequently strong in the California tertiary basins but a quantitative basis is obtained. The method is considered to have application to other areas. R. S. R.

LAND, PHYSICS OF THE.

1202. State of the earth's core. J. LYNCH. *Bull. Seism. Soc. Amer.*, **30**, *pp.* 337–341, *Oct.*, 1940.—The phenomena supporting the assumption of a fluid core are : (1) the temperature gradient in the earth's crust, (2) earth tides, (3) the period of the earth's precession, and (4) the fact that shear waves are not transmitted. Recently independent observers at widely different places observed feeble shear waves of small energy. The author made experiments on the effect of occluded H_2 on the rigidity of Pd ; the method is described in detail. The results give a straight line connecting occlusion with change of rigidity, and it is suggested that the core is a solid solution with occluded H_2. This permits feeble shear waves and gives the low rigidity required for tidal action and the Eulerian period. R. S. R.

1203. Capillary forces in natural soils. G. RAM AND V. I. VAIDHIANATHAN. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 77–84, *Jan.*, 1941.—An apparatus is described by which different heights of columns of soil can be examined and negative pressures determined. Measurements were made on 12 graded samples varying from coarse sand to fine silt containing clay, the effect of varying length of column was examined for 2 specimens of sand, and, to ascertain the effect of dry sand on the capillary column, dry sand was introduced on top of the wet column and negative pressure was determined after different time intervals. Capillary constants are calculated and tabulated. Results indicate that the capillary theory of a bundle of tubes cannot apply to natural soils, that the negative pressure is independent of the length of the column, within the capillary height, and that even if the column of soil is greater than the capillary height there is no effect on the negative pressure. N. M. B.

1204. Report on earth tides. W. D. LAMBERT. *Spec. Publ. U.S. Cst Geod. Surv. No.* 223, [24 *pp.*], 1940.—The paper comprises a report presented to the Seventh General Assembly of the I.A.G. at Washington in Sept., 1939. Recent work on tides in the solid earth is classified and discussed under the following heads: deflections of the vertical referred to the adjacent ground (measured geodetically), deflections referred to the earth's axis (measured astronomically), and tidal variations in gravity at a given station. Tides in wells remote from the sea are also discussed as manifestations of earth tides, and an Appendix suggests the use of a dilatometer for observing similar effects. Instrumental and theoretical advances in the subject since the 1936 Report are described. The author concludes that the main obstacle to further advance is still the difficulty of interpreting the available results in terms of the earth as a whole and of the local geological structure. A. HU.

METEOROLOGY.

1205. Measurement of atmospheric ozone by a quick electrochemical method. F. A. PANETH AND E. GLÜCKAUF. *Nature, Lond.*, **147**, *pp.* 614–615, *May* 17, 1941.

1206. Adjustment of airport station pressure records to former city station elevation. W. W. REED. *Mon. Weath. Rev., Wash.*, **68**, *pp.* 344–347, *Dec.*, 1940.

1207. Temperature of the upper atmosphere. A. C. DEB. *Sci. and Culture*, **6**, *pp.* 502–507, *March*, 1941.—As supporting the assumption of a high temperature in the upper regions of the atmosphere the following sources of evidence are discussed : (1) Extension of auroral rays to great heights, (2) escape of He from the terrestrial atmosphere, (3) width of the green line (λ 5 577) of light from the night sky, (4) comparative thickness of the regions E and F of the ionosphere, and (5) absorption of radio waves in the region F. While accurate values of temperature, or temperature gradient cannot be deduced, it is concluded that the temperature is of the order of 1 000°–2 000°K. above 300 km. This is ascribed to absorption of the whole of the extreme ultra-violet solar radiation. R. S. R.

1208. Night radiation and unusual min. temperatures near New Orleans, La. W. F. McDONALD. *Mon. Weath. Rev., Wash.*, **68**, *pp.* 181–185, *July*, 1940.—The author cites 14 instances during the last 4 years when min. temperatures differing by 20°F. or more have been simultaneously recorded at 2 stations in the Mississippi delta differing in altitude by 80 ft. and in horizontal distance by less than 6 miles. These extreme differences are ascribed to the radiative efficiency of the dense unbroken vegetation surrounding the station showing the lower minima. The cold air produced by this night radiation is localized close to the observing station by the river levees. A. HU.

1209. Observations of nocturnal radiation at Fairbanks, Alaska, and Fargo, N. Dak. H. WEXLER. *Mon. Weath. Rev., Wash., Suppl. No.* 46, [21 *pp.*], 1941.—Measurements of outgoing radiation were made at these stations during the winters of 1936–37 and 1937–38 by means of

Abbot-Aldrich melikerons. Linear equations are deduced relating the radiative flux to surface air temperature, and the curves for clear-weather radiation are compared with theoretical ones obtained from various models representing the ideal structure of polar continental air. Deviations from the theoretical curves are discussed in relation to defects of the models and of the observations. Linear relations are given between the atmospheric radiation and the cloud amount. A. Hu.

1210. Radiative cooling in the lower atmosphere. W. M. Elsasser. *Mon. Weath. Rev., Wash.*, **68,** *pp.* 185–188, *July*, 1940.—Results are given of a graphical method of determining radiative heat transfer in the first 5 km. of the atmosphere, as applied to 12 stations located in two N.-S. cross-sections of the U.S. The losses by free air cooling due to long-wave water vapour radiation and by cloud cooling are separately computed, and the part played by nocturnal ground inversions is discussed. Radiative cooling in a clear sky is about 1° per day in polar air masses and 2° to 3° in equatorial air masses. With respect to long-wave radiation the atmosphere is a cold source throughout, so that all the heat lost must be supplied by condensation, turbulence and convection. A. Hu.

1211. Aerology in the hurricane warning service. G. E. Dunn. *Mon. Weath. Rev., Wash.*, **68,** *pp.* 303–315, *Nov.*, 1940.—The author points out the extent of the aerological information now available in the tropics or semi-tropics S. and E. of the U.S. The possibilities of using pilot-balloon, aeroplane and radiosonde data, in hurricane forecasting are canvassed, special reference being made to a series of disturbances in Sept. 1937, and to the severe hurricane of Sept. 1938. Charts of wind direction and velocity at 10 000 ft. are given for these storms, and the need for further upper-air observations is emphasized. A. Hu.

1212. The Chinook wind east of the Canadian Rockies. H. L. Osmond. *Canad. J. Res. A*, **19,** *pp.* 57–66, *April*, 1941.—A number of salient features of the Chinook are established. The most important one is that of the pressure distribution associated with a Chinook. This involves the establishment of a pressure trough between 2 anticyclones, one on each side of the Rocky Mountain ridge. The location of this trough relative to the ridge is extremely important. In order that a strong Chinook occur, the trough must lie in the lee of the Rockies. It is shown also that the region of the Chinook is in southern Alberta, extending a short distance E. from the mountains. Author.

1213. Motion of atmospheric disturbances. B. Haurwitz. *Sears Foundation, J. Mar. Res.*, **3,** *pp.* 35–50, *May* 1, 1940.—The author extends the simple theory giving the effect of the latitudinal variation of the Coriolis force on the propagation of atmospheric disturbances to allow for the finite lateral extent of the disturbances, for the influence of friction, and for the action of an external force. When the lateral extent of the disturbance is finite, the difference between geostrophic wind and velocity of propagation of the disturbance becomes smaller than in the simple case. When the disturbance is stationary its wavelength is larger than in the case of infinite extent. The main effect of friction is to damp the disturbance. An external force which is a function of the longitude generates a stationary disturbance of the same wavelength as the free disturbance if there were no external force. A. Hu.

1214. Motion of atmospheric disturbances on the spherical earth. B. Haurwitz. *Sears Foundation, J. Mar. Res.*, **3,** *pp.* 254–267, *Dec.* 17, 1940.—The author's previous work is extended to disturbances covering large fractions of the earth's surface, so that its sphericity has to be allowed for. The spherical shape of the earth and the latitude variation of the rotational deflecting force determine the horizontal dimensions of cells of high and low pressure and their velocity with respect to the zonal atmospheric motion. If the position of the cells is fixed by geographical considerations, a certain zonal velocity will increase their intensity, provided that the "forced" distribution of the cells coincides with the possible "free" distribution on a homogeneous earth. Strong zonal circulation produces a small number of intense cells which, with weak zonal circulation, break up into many smaller centres. A mechanism is suggested which may account for the observed changes between times of strong and weak zonal circulation. A. Hu.

1215. Synoptic and aerological study of a thunderstorm day at Agra, Dec. 3rd, 1936. S. Basu and R. Sahay. *Sci. Notes Indian Met. Dep.*, **8,** 89, *pp.* 67–75, 1940.—A line-squall passed over Agra at about 10.30 a.m. On that day 2 sounding balloons with meteorographs were let off, one at about noon, after the passage of the squall, and the other in the afternoon at about 5 p.m. Both these instruments were later retrieved, and their records were found to reveal some very interesting features. An examination of all the available data was therefore undertaken to study the weather situation of the day. The examination suggests the thunderstorm to have been caused by the passage of a cold front in association with the secondary low of a western depression over east Rajputana. The front was a weak one inasmuch as the southward and eastward flow of the cold dry air was not maintained in the wake of the front; on the other hand, the region traversed by the cold front was overrun by a comparatively warmer and moister air within 12 hrs. of the passage of the front. A rough calculation of the slope of the cold front at noon and evening of the 3rd Dec. is given. The analysis suggests a probable surface of subsidence to have existed in association with the front. AUTHORS.

1216. Agricultural meteorology: monthly sequence of summer precipitation at Winnipeg, Swift Current, and Edmonton. J. W. HOPKINS. *Canad. J. Res. C.*, **19,** *pp.* 85–94, *April*, 1941.—An analysis of the monthly sequence of rainfall during the summer period April–Sept. of the years 1890–1937, made by expressing each annual sequence as a fifth-degree polynomial function of time, indicates that despite marked annual variability the average monthly precipitation at all 3 stations exhibits a definite seasonal trend, with the max. incidence of rain in June or July. At Winnipeg the relative monthly distribution remains, on the average, essentially the same in both wet and dry years, but at Swift Current and Edmonton it is modified to some extent, the mid-season max. being relatively more pronounced in seasons of above-average total precipitation. At Swift Current both the total amount and one of the coefficients specifying the monthly distribution of precipitation show some oscillatory variation with time; and at Edmonton there has been a slight progressive change such that a smaller proportion than formerly of the total precipitation now falls in the second half of the season (July–Sept.). No consistent increase or decrease in rainfall over the 48-year period has been recorded at any of the 3 stations. AUTHOR.

1217. Ablation at high altitudes and under high solar incidence. N. E. ODELL. *Amer. J. Sci.*, **239,** *pp.* 379–382, *May*, 1941.

1218. Meteorological results of the Byrd Antarctic Expeditions 1928–30, 1933–35. G. GRIMMINGER. *Mon. Weath. Rev., Wash., Suppl. No.* 42, [105 *pp.*], 1941.—Tabular and graphical summaries of data.

1219. Variability of the thermo-electric pyrheliometer factor. I. F. HAND. *Mon. Weath. Rev., Wash.*, **68,** *pp.* 339–344, *Dec.*, 1940.—The results of a series of tests of thermo-electric pyrheliometers against the Marvin and silver-disc pyrheliometers are tabulated and discussed. Under the prescribed conditions the results are equally good with the new type. This type of instrument is more rapid in use, gives continuous readings, and the construction is simple. The vacuum type with portable potentiometer is valuable in the field because of its light weight, and it assumes equilibrium in 6 sec., but probable errors are less with the non-vacuum type. All the types tested show greater efficiency with very low free-air temperatures. R. S. R.

***1220. Dew-point recorder for measuring atmospheric moisture.** C. W. THORNTHWAITE AND J. C. OWEN. *Mon. Weath. Rev., Wash.*, **68,** *pp.* 315–318, *Nov.*, 1940.—A thin metal mirror is attached to one end of a copper rod cooled continuously at the other end. Immediately under the mirror is a heating element which operates, on closing a switch, to counteract the flow of heat from the mirror. The switch is operated against a spring by the output of a photocell whose sensitive surface receives the light of a lamp reflected from the mirror surface. Heat is conducted away from the mirror until it reaches the dewpoint, when deposition of moisture reduces the light reaching the cell and switches on the heater. The temperature of the mirror is thus held at the dew-point and is continuously recorded by means of a thermocouple. A. HU.

1221. Average daily air mass. R. E. KENNEDY. *Mon. Weath. Rev., Wash.*, **68,** *pp.* 301–303, *Nov.*, 1940.—Curves are given showing the average daily air mass as a function of latitude of the observing station and declination of the sun. The methods used in constructing the graphs and in allowing for atmospheric refraction are described. A. HU.

SEISMOLOGY.

1222. Response of a torsion seismometer to sustained vibrations. D. S. CARDER. *Bull. Seism. Soc. Amer.*, **30,** *pp.* 343–351, *Oct.*, 1940.—The vibration meter of the U.S. Coast and Geodetic Survey is essentially a torsion seismometer acting virtually as a horizontal pendulum. A sharp blow or h.f. vibration causes a "bowstring" vibration. In the tests the harmonic oscillations are produced by a shaking table. It is found that the harmonic magnification formula is applicable to the torsion seismometer when the period exceeds 4 T_s, where T_s is the bowstring period. The response curve has a point of inflection for the bowstring period and there are also 2 peaks. The theory of these vibrations is developed and the results discussed. R. S. R.

TERRESTRIAL ELECTRICITY AND MAGNETISM.

1223. Effective separation of points discharging atmospheric electricity. J. A. CHALMERS. *Phil. Mag.*, **31,** *pp.* 363–372, *May*, 1941.—The various phenomena which contribute to the effective separation of discharge points for atmospheric electricity are reviewed and discussed. Further experimental work is suggested. The balance of evidence indicates that the effective separation of points at Durham is below 120 m. If this is so, continuous rain-clouds are bipolar. The altielectrograph estimates of potential gradients appear to be incorrect. The Eiffel Tower observations require 2 processes of separation, one within the cloud and one below the level of the top of the tower. A. J. M.

1224. The ionosphere at Huancayo, Peru, July to September, 1940. H. W. Wells and R. C. Coile. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 83–86, *March*, 1941.

1225. The ionosphere at Watheroo, W. Australia, July to September, 1940. W. C. Parkinson. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 79–82, *March*, 1941.

1226. Magnetic disturbances and region F_2 of the ionosphere. J. Bannon, A. J. Higgs and G. H. Munro. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 61–70, *March*, 1941.—The noon critical frequencies in region F_2 of the ionosphere above Liverpool, N.S.W., and Mt. Stromlo, Canberra, are significantly associated with the magnetic character-figures for the days in question, abnormal differences occurring on greatly disturbed days. Smaller disturbances, however, are distributed at random. Frontal conditions thus do not cause magnetic disturbances but intensify those otherwise produced. It is suggested that the *D* current-system is located to a great extent in region F_2. A. Hu.

1227. Cosmic radiation and magnetic storms. A. R. Hogg. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 51–58, *March*, 1941.—This paper deals with the results of cosmic-radiation measurements in relation to magnetic storms during 1936–39. The results show that over this period of 4 years: Major deviations of the cosmic-radiation intensity were always negative in sign. Such major deviations were, in the great majority of cases, if not in all, associated with disturbances in the earth's magnetic field. The cosmic-radiation disturbance usually became apparent a few hrs. after the onset of the magnetic storm. Magnetic storms were in all cases accompanied by a decrease in cosmic-radiation intensity, ranging from 0·5% to 5%. The greater the range of *H* during the storm, the greater, on the average, was the cosmic-ray disturbance. The average course of a cosmic-ray disturbance bears some broad resemblance to the course of a magnetic storm. Author.

1228. Geomagnetic ring-current. I. Radial stability. S. Chapman and V. C. A. Ferraro. *Terr. Magn. Atmos. Elect.*, **46**, *pp* 1–6, *March*, 1941.—The decrease of the earth's horizontal magnetic force during a geomagnetic storm is attributed to an equatorial electric ring-current of which the radius is a small multiple of that of the earth. The stability of such a ring for variations of its radius about an equilibrium value is considered by examining an analogous cylindrical current-sheet. The sheet is found to be stable only if the internal magnetic field it produces is less than $\frac{2}{3}$ the permanent field at the sheet itself. A similar conclusion probably holds for the ring-current, possibly with a moderate change in the numerical factor. The period of these radial oscillations is considered, and it is suggested that they may account for some of the world-wide fluctuations of the earth's field during magnetic storms. A. Hu.

1229. Analysis of surface magnetic fields by integrals. I. E. H. Vestine. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 27–41, *March*, 1941.—In geophysical applications the method is free from some of the limitations usual to spherical harmonic analysis. A practical means is afforded for separating a magnetic field observed over a closed regular surface into parts originating inside and outside the surface. Relations between the potential and its space-derivatives in the immediate neighbourhood of a closed surface are developed, especially for spherical and plane surfaces. The method of surface integrals may be used for complicated magnetic fields, such as those of magnetic storms, and in magnetic geophysical prospecting. It is naturally adapted to numerical and possibly machine procedures. Author.

1230. Isomagnetic charts. III. The isogonic and *X*-, *Y*-charts for the centred dipole field. IV. Geomagnetic dip-poles, their nature and that of the isomagnetic lines in their neighbourhood. S. Chapman. *Terr. Magn. Atmos. Elect.*, **46**, *pp.* 7–26, *March*, 1941.—[Abstr. 369 (1941).] Various forms of the equations of the isogonic lines are derived for the field of the centred magnetic dipole. The isogonic chart for this field is shown to have 2 singular points in addition to the 4 uniform ray-poles (one at each magnetic or geographic pole); these singular points, which are situated at the intersections of the magnetic and geographic equators, are rectangular nodes. The equation and form of the nodal curves are discussed. The area over which the magnetic declination exceeds the obliquity of the magnetic axis is also considered ; it is shown to cover more than 1/3 of the whole area of the sphere, however small the obliquity may be. The *Y*- and *X*-isomagnetic charts are also briefly considered ; the former has only 2 singular points, namely non-uniform ray-poles at the geographic poles ; these are also (non-uniform) ray-poles of the *X*-chart, which in addition has 2 nodes at the same points as those of the *D*-chart ; but in the case of *X* these nodes are not rectangular.—Geomagnetic dip-poles are singular points (on the terrestrial surface) of the magnetic equipotential lines, and vice versa. The dip-poles of a uniformly magnetized sphere have many special properties not in general characteristic of dip-poles. The principal geomagnetic dip-poles are defined as the principal max. and min. of the surface magnetic potential ; the equipotential lines surrounding them are elliptic, not circular. The nature of magnetic meridians and isomagnetic lines for *V*, *I*, *H*, *F* and *Z*, near a dip-pole is examined ; dip-poles are in general ordinary points as regards *F* and *Z* ; for *H* they are principal min. foci of a special conical type, and for *I* they are principal max. of conical type. Dip-poles are in general not isogonic ray-poles. The isomagnetic lines near special types of dip-pole are considered. AUTHOR.

1231. Geomagnetic 3 hr. range indices for the years 1937 and 1940. H. F. JOHNSTON AND N. H. HECK. *Terr. Magn. Atmos. Elect.*, **46,** *pp.* 95–117, *March,* 1941.

1232. New magnetic observatory at Sitka, Alaska. W. D. PATTERSON. *Terr. Magn. Atmos. Elect.*, **46,** *pp.* 87–94, *March,* 1941.

1233. Lunar diurnal variation of horizontal and vertical magnetic forces at the polar-year station, Mogadiscio. J. EGEDAL AND M. BOSSOLASCO. *Terr. Magn. Atmos. Elect.*, **46,** *pp.* 59–60, *March,* 1941.

1234. Lightning and its symbols. J. F. SHIPLEY. *Quart. J. Roy. Met. Soc.*, **67,** *pp.* 135–151, *April,* 1941.

RADIOACTIVITY.

1235. Determination of Ra quantities in highly emanatory preparations by measuring the emanation in the nascent state. R. JANITZKY. *Kolloid Zschr.*, **89,** *pp.* 316–319, *Nov.*, 1939. *In German.*—Contrary to older statical methods the new dynamical method consists in blowing a certain constant quantity of air through the receptacle containing the Ra solution. After being dried, this air—containing as much emanation as has been developed by the preparation during the time of flow—is led to an evacuated ionization chamber where the amount of emanation is measured. For strong preparations an auxiliary dilution apparatus is used. The time required for this measurement is short compared with that of previous methods. R. N.

1236. Concentration method for certain radioactive metals. J. STEIGMAN. *Phys. Rev.*, **59,** *pp.* 498–501, *March* 15, 1941.—An extension of the Szilard-Chalmers concentration technique to radioactive metals is discussed. The principle involved is the choice of certain metal complex compounds which are highly stable and which have also been resolved into stable optical isomers. The technique is applied to Co, Ir, Rh and Pt complex salts, with resulting high concentration ratios. AUTHOR.

1237. Radioactivity of Mn^{56} and I^{128}. R. H. BACON, E. N. GRISEWOOD AND C. W. VAN DER MERWE. *Phys. Rev.*, **59,** *pp.* 531–538, *April* 1, 1941.—The β-ray spectra of Mn^{56} and I^{128} as seen in the Wilson cloud chamber were examined in an effort to correlate the measurements with the Fermi or the Konopinski-Uhlenbeck theory. A study of the γ-rays which accompany these β-rays was made. In all measurements the difficulties of cloud-chamber technique were critically investigated. The results fit the Fermi better than the K-U theory. AUTHORS.

1238. Absolute number of quanta from the bombardment of fluorine with protons. J. A. VAN ALLEN AND N. M. SMITH, JR. *Phys. Rev.*, **59,** *pp.* 501–508, *March* 15, 1941.—With a specially designed variable-pressure absorption-cell ionization chamber, to facilitate clear distinction between the short-range α-particles and the scattered protons, the angular distribution and total yield of α-particles at the lowest resonance (330 kV) were determined. The determinations were based on plateaus appearing in curves of counting rates as a function of (1) cell pressure, (2) counter bias, and (3) bombarding voltage at angles of 60°, 90°, 120°, and 150° with respect to the proton beam. The results show that : (*a*) To within 2% the angular distribution of the α-particles is spherically symmetric ; (*b*) the yield over 4π steradians is $8{\cdot}9 \pm 0{\cdot}5 \times 10^4$ α-particles per μC of 360 kV protons bombarding a thick crystal of CaF_2. With both a heavily shielded counter and a similarly protected electroscope the ratio of the γ-ray intensity at 1 050 kV to that at 370 kV was found to be $42{\cdot}0 \pm 0{\cdot}8$. The angular distribution of the γ-radiation was found to be spherically symmetric to within the experimental error of 5%. AUTHORS.

1239. γ-rays emitted from Rn and MsTh-I and their daughter elements. J. ITOH AND Y. WATASE. *Proc. Phys.-Math. Soc., Japan,* **23,** *pp.* 142–159, *Feb.*, 1941.—The relative intensities of several strong γ-rays, whose existence had already been established by internal conversion of β-rays, were determined directly by means of the magnetic spectrometer. From these values and the absolute intensities of conversion β-rays the internal conversion coefficients were calculated, and comparing them with the theoretical values obtained by Hulme the nature of the radiations, whether dipole or quadripole, was deduced. In the case of the Th series improved level schemes for ThC and ThC′ and ThD are proposed in connection with β- and α-transformations. AUTHORS.

*** 1240. Light-weight h.v. supply for Geiger counters.** H. V. NEHER AND W. H. PICKERING. *Rev. Sci. Instrum.*, **12,** *pp.* 140–142, *March*, 1941. [Abstr. 910B (1941)].

*** 1241. Magic eye ionization gauge.** L. N. RIDENOUR. *Rev. Sci. Instrum.*, **12,** *pp.* 134–136, *March*, 1941. [Abstr. 909B (1941)].

*** 1242. Regulated battery-operated h.v. supply** J. G. BARRY. *Rev. Sci. Instrum.*, **12,** *pp.* 136–139, *March*, 1941. [Abstr. 911B (1941)].

*** 1243. Radiometric titration with radioactive phosphorus as end point indicator.** A. LANGER. *J. Phys. Chem.*, **45,** *pp.* 639–643, *April*, 1941.—A volumetric method is described for the determination of the end point of a precipitation reaction by the change in the radioactivity of the solution. The radioactivity is measured with a Geiger-Müller counter, specially adapted for liquids, and a counting device. Titration curves of Mg and U with Na_3PO_4 and of phosphate with Mg, using radioactive P as indicator, are included. AUTHOR.

See also Abstracts 1358, 1367.

RADIATION.

ABSORPTION.

See Abstract 1377.

COLORIMETRY.

1244. Colour determination. P. MOON. *Illum. Engng, N.Y.*, **36,** *pp.* 313–334 ; *Disc.*, 334–335, *March*, 1941.—A colour specification can be obtained either by calculation from the spectroradiometric curve or by direct measurement. Both methods are discussed and their application to lamps, filters and reflecting surfaces, is considered. AUTHOR.

1245. Colour systems and their inter-relation. D. B. JUDD. *Illum. Engng, N.Y.*, **36,** *pp.* 336–369 ; *Disc.*, 369–372, *March*, 1941.—A general account of the principal methods in use for colour nomenclature and specification. Those based on combinations of lights are (*a*) tristimulus specification, either on the I.C.I. standard co-ordinate system or one of its linear homogeneous transformations, (*b*) polar co-ordinate specification by dominant wavelength and purity. Systems based on material standards are divided into (*c*) those employing transparent media (Lovibond glasses, Arny solutions), and (*d*) those using coloured surfaces (Munsell, Ostwald, various colour dictionaries). A description is also given of the method of designating colours developed by the Inter-Society Colour Council and the National Bureau of Standards. J. W. T. W.

1246. Illuminant in colour matching and discrimination. D. NICKERSON. *Illum. Engng, N.Y.*, **36,** *pp.* 373–392 ; *Disc.*, 393–399, *March*, 1941.—A number of illuminants of different types have been examined to determine how closely any one of them will give results in accord with another when used for colour grading or colour matching samples, particularly cotton. For Abbott daylight the best reproduction is obtained with the special carbon arc examined ; for I.C.I. illuminant *C* the best is a Macbeth artificial daylight (Macbeth 6 800 K). The results are expressed in tabular form, a numerical index showing the degree of duplication obtainable with any selected pair of illuminants. J. T. W. W.

See also Abstract 1303.

ELECTRO-OPTICAL AND MAGNETO-OPTICAL EFFECTS.

See Abstract 1368.

EMISSION.

1247. Cosmic rays : recent developments. P. M. S. BLACKETT. *Proc. Phys. Soc., Lond.*, **53,** *pp.* 203–213, *May*, 1941.—The author deals particularly with the problem of the energy spectra of the various kinds of rays. A discussion is given of the absorption law of the penetrating rays, and it is shown that a power law is a reasonable approximation. From this law the energy spectrum of the mesons can be deduced. It is suggested that the difference in absorption of the penetrating component in gaseous and in solid absorbers is due to the decay of the mesons into electrons. A discussion is given of the soft component produced in the form of showers by the mesons, and it is shown that their observed distribution may be reconciled with the observed energy spectrum of the meson. Possible explanations for the proton component are given. In discussing the energy spectrum of the incident electrons it is shown that the power law probably holds over a very wide range of energy. The various suggestions on the origin of the mesons are outlined and criticized, in view of the fact that the two primary components, the electrons and the protons, have the same spectra. Finally some speculations are advanced on the origin of the power law for the energy spectrum. G. O. B.

1248. Differential measurement of the meson lifetime. W. M. Nielsen, C. M. Ryerson, L. W. Nordheim and K. Z. Morgan. *Phys. Rev.*, **59**, *pp.* 547–553, *April* 1, 1941.—Measurements of the meson lifetime were made by comparing the Pb absorption curves of the cosmic radiation at 2 different elevations and by compensating the air column at the higher level by a layer of graphite placed on top of the counter telescope. The method does not require any knowledge of the energy distribution or of the height of the producing layer of the mesons. Authors.

1249. Wavelength of ultra-violet radiation capable of producing ozone and the effect of pressure. E. Briner and E. Perrottet. *Arch. Sci. Phys. Nat.*, **22**, *Nov.–Dec.*, (*Suppl. No.* 4, *C. R. Soc. Phys. Hist. Nat., Genève*, **57**, 4, *pp.* 239–241), 1940. *In French.*

See also Abstracts 1198, 1227.

FLUORESCENCE & PHOSPHORESCENCE. LUMINESCENCE AND AFTERGLOW.

1250. Fluorescence with monomethene-cyanin dyestuffs, especially reversible polymers. I–II. F. Katheder. *Kolloid Zschr.*, **92**, *pp.* 299–324, *Sept., and* **93**, *pp.* 28–51, *Oct.*, 1940. *In German.*—The researches were carried out with monomer and polymer dyestuff solutions and referred especially to measurement of the decay of fluorescence [see Abstr. 897 (1919)]. As substances for extinguishing the fluorescence phenols, tri- and trioxy-benzenes and the H ion are especially suited. There is a difference in principle between the extinguishing properties with monomers and with reversible polymers. The former show only a small sensitivity to additional foreign substances while in the latter the fluorescence is very sensitive in the presence of such substances. This fact is explained by an increased faculty in the latter case for transmitting the excitation energy of the irradiated light. For both cases a mathematical representation is developed for the curves of fluorescence decay, based on kinetic conceptions and furnishing a relation between decay and concentration. The formulae allow of determining the degree of polymerization. R. N.

1251. The yellow fluorescent form of Zn silicate. H. P. Rooksby and A. H. McKeag. *Trans. Faraday Soc.*, **37**, *pp.* 308–311, *June*, 1941.

INTERFERENCE, DIFFRACTION AND SCATTERING.

1252. Diffraction, by a black body, of light from an isotropic point source. P. Barreca. *Arch. Sci. Phys. Nat.*, **23**, *pp.* 234–261, *Sept.–Oct.*, 1940. *In French.*—The complete integral to the indefinite optical equation is derived for this case of diffraction ; and the method of deducing the general integral from it, in particular simple cases, when the quadrature has been carried out, is indicated briefly. C. B. A.

1253. Theory of anomalous diffraction gratings and of quasi-stationary waves on metallic surfaces (Sommerfeld's waves). U. Fano. *J. Opt. Soc. Amer.*, **31**, *pp.* 213–222, *March*, 1941.—The theory of Wood's anomalous diffraction gratings has been re-examined in order to visualize its physical meaning. Each wave diffracted by a grating is identified through the component of its wave vector tangential to the grating. Surface waves similar to those found in total internal reflection are included. The amplitudes of these waves can be calculated by successive approximations. One feature of the anomalies is connected with the infinite dispersion of spectra at grazing emergence. Emphasis is laid on the existence of polarized quasi-stationary waves which represent an energy current rolling along the surface of a metal. These waves can be strongly excited on the surface of metallic gratings under critical conditions depending on the profile of the grooves ; secondary interference phenomena arise in the observed spectra. The connection of the quasi-stationary surface waves with the wireless earth waves is discussed. Author.

See also Abstract 1164.

PHOTOCHEMISTRY (INCLUDING PHOTOGRAPHY).

1254. Stop size and screen distance for half-tone negatives for blockmaking. F. J. Tritton. *Photogr. J.*, **81**, *pp.* 235–244, *May*, 1941.—The author compares the penumbral theory relating size of stop to screen distance with the diffraction theory, with a view to settling which best describes the optics underlying the formation of the half-tone dot. This is attempted experimentally by examining the predictions of the two theories when the camera setting is modified. The results lend slightly more support to the penumbral theory. The 2-stop method of negative making is explored experimentally, and tables of recommended stop sizes and screen distances are given. A. Hu.

1255. Photo-oxidation of iodide ion sensitized by eosin. R. Livingston and F. Hurd. *J. Phys. Chem.*, **45**, *pp.* 547–559, *April*, 1941.—The quantum yield of the photo-oxidation of iodide ion sensitized by eosin was measured as a function of the light intensity, the temperature, and the concentrations of iodide ion, hydrogen ion, and dye. The yield increases with the concentration of iodide and hydrogen ions, is practically independent of the temperature and of the dye concentration, and is inversely proportional to $\sqrt[3]{(\text{intensity})}$. Authors.

1256. Cd photosensitized reactions of propane. E. W. R. Steacie, D. J. LeRoy and R. Potvin. *J. Chem. Phys.*, **9**, *pp.* 306–314, *April*, 1941.—An investigation has been made of the Cd (5^3P_1) photosensitized reactions of propane and of propane-hydrogen mixtures at a temperature of 310°C. The main products are hydrogen and hexanes, together with smaller amounts of methane, butane, pentanes and heptanes. The quantum efficiency of propane decomposition is roughly 0·6. More C–C bond splitting occurs than is the case in the mercury photosensitized reaction at the same temperature. A possible explanation of this is that reactions are occurring which involve the CdH molecule. Authors.

1257. Preparation of some condensation products of *m*-dialkylaminobenzaldehydes with compounds containing reactive methylene groups, and an investigation of their suitability as photographic sensitizers. W. Cocker and D. G. Turner. *J. Chem. Soc.*, *pp.* 143–145, *March*, 1941.

1258. Silver in the photographic process. K. Schaum. *Kolloid Zschr.*, **89**, *pp.* 211–214, *Nov.*, 1939. *In German.*

See also Abstracts 1263, 1364.

PHOTOMETRY.

***1259. Prism and sector photo-electric photometers for determination of concentrations in gaseous or liquid systems.** L. Harris, J. A. Kyger and C. N. Sjogren. *J. Opt. Soc. Amer.*, **31**, *pp.* 263–267, *March*, 1941.

***1260. Photo-electric photometer for vitamin A estimation.** A. E. Parker and B. L. Oser. *Industr. Engng Chem.* (*Analytical Edition*), **13**, *pp.* 260–262, *April* 15, 1941.—Describes an instrument which is, in effect, a photo-electric transmissometer for wavelength 330 mμ, the absorption of a solution at this wavelength being a measure of vitamin A content. The source used is a sodium arc with red-purple Corex A filter. The receptor is a sodium photocell sensitive to ultra-violet. The circuit is described and a series of results obtained with different solutions are given. Part of the paper is devoted to a comparison between the results obtained with this instrument and those obtained by other observers using other methods. J. W. T. W.

***1261. New transmission photometer.** *Electrician*, **126**, *pp.* 245–246, *April* 25, 1941.—[Abstr. 3144 (1940)].

***1262. Portable meters for measurement of light and ultra-violet energy.** M. Luckiesh and A. H. Taylor. *Gen. Elect. Rev.*, **44**, *pp.* 217–221, *April*, 1941.—Various types of portable meters using photo-tubes are described. The first of these is operated from 115 V a.c. mains and uses a Cd alloy photo-tube with a valve amplifier for integrating the ultra-violet energy in any light source. When a Cs photo-tube is used a sensitive meter is obtained for light or visible energy and for energy in the near infra-red. Of 2 pocket-size meters, one is battery-operated, while the other is operated from a.c. mains. In these the photo-tube is connected in series with any 1 of 3 condensers to vary the sensitivity. The tube current charges the condenser which in turn discharges through a ¼ W neon lamp and telephone connected across the condenser. Audible clicks occur in the telephone at each discharge and the ultra-violet intensity incident on the photo-tube is proportional to the rate of these clicks. For the measurement of germicidal ultra-violet energy a meter is used incorporating a light-sensitive cell of the blocking-layer type and a sensitive microammeter. A daylight f.c. indicator employs relays and a reversible motor to operate a large pointer. It has been found that spectral distribution curves for daylight plotted on an equal illumination basis all intersect at about 5 600 Å. A filter is therefore used with a narrow transmission band at 5 600 Å and the resulting photo-current is then almost directly proportional to the f.c. incident on the tube, whatever the quality of the light being measured. A. W.

***1263. Simple apparatus for tracing spectral sensitivity curves.** E. A. Harvey. *Photogr. J.*, **81**, *pp.* 231–234, *May*, 1941.—Wedge spectrograms taken for determining the spectral sensitivity of a photographic emulsion are usually reprinted on contrasty material in order to obtain a sharp isopaque bounding the sensitivity curve. The density to which this isopaque corresponds is, however, unknown. The paper describes a simple non-automatic recording photo-electric photometer for tracing such isopaques at different known densities from a single wedge spectrogram. A. Hu.

POLARIZATION.

See Abstract 1106.

REFLECTION, REFRACTION AND DISPERSION.

1264. Reflection and refraction of photons. E. T. Jones. *Phil. Mag.*, **31,** *pp.* 394–404, *May*, 1941.—The reflection and refraction of vibratory doublet photons [Abstr. 4688 (1937)] at the surface of a transparent isotropic medium are considered. The dispersion of photons is determined by the laws of vibrations of coupled systems, and imaginary values of the refractive index do not occur in the photon theory. A photon moving in free space has attached to it a plane electron wave-sheet which enables it to become coupled with other electrons situated in the plane through the photon transverse to the direction of motion. The relations between angles of incidence, refraction and reflection, follow from the condition that the wave-sheet attached to an incident photon must be unbroken at the interface separating the two media. The intensities of reflected and refracted pencils are determined from the probability of reflection or refraction of a photon, which depends on the change of direction of motion during reflection or refraction. This probability is assumed to be proportional to the square of the component along its direction of the original propagation vector. When other factors are taken into consideration, Fresnel's results are obtained directly. The theory explains the discrepancy between Fresnel's tangent formula and experiment without assuming modifications in the state or nature of the refracting surface. C. B. A.

1265. Effect of ions of the lyotropic series on reflection in the 3μ region. A. M. Buswell, R. C. Gore and W. H. Rodebush. *J. Phys. Chem.*, **45,** *pp.* 543–546, *April*, 1941.—The infra-red reflection of solutions of several ions, referred to the reflection of water in the 3 μ region, was determined. The effect of the ions is to increase the reflectivity of the water and to shift the max. of reflection toward higher frequencies, as found in the vapour phase. These effects are the same as would be expected if the ions produced a decrease in the amount of the 4-co-ordinated water structure. Authors.

1266. Refractive index of liquid water in the near infra-red spectrum. M. Centeno V. *J. Opt. Soc. Amer.*, **31,** *pp.* 244–247, *March*, 1941.

1267. Anomalous dispersion and dielectric loss in polar polymers. J. G. Kirkwood and R. M. Fuoss. *J. Chem. Phys.*, **9,** *pp.* 329–340, *April*, 1941.—A theory of dielectric loss of polar polymers at high dilution in a non-polar plasticizer is developed. The theory leads to a broad distribution in relaxation times, associated with the internal rotatory Brownian motion of the hydrocarbon chain. An approximate relation between the degree of polymerization, the frequency of max. loss and the viscosity coefficient of a polar plastic, is obtained. The loss factor is calculated from the theoretical relaxation time distribution for a mono-disperse polymer and for a poly-disperse polymer with an exponential distribution in chain length. The theoretical loss factor is compared with the experimental loss factor of polyvinyl plasticized with diphenyl. The agreement with experiment is semi-quantitative. Authors.

1268. Hints on the use of lens systems in industry. W. D. Wright. *J. Sci. Instrum.*, **18,** *pp.* 53–57, *April*, 1941.—Recognition of the different types of lens and of the right way to use them is explained and typical applications of corrected, uncorrected and cylindrical lenses, are described. W. S. S.

1269. Some Cd-, Se- and S-containing glasses, with sharp cut-off and high total light transmission. J. E. Stanworth. *J. Soc. Glass Technol.*, **25,** *pp.* 95–99(*T*), *Feb.*, 1941.—Batch compositions are given for 2 glasses containing Cd, S and Se, and having a sharp cut-off at 5400 Å and 5900 Å, respectively, when blown into the form of bulbs of wall thickness approx. 1 mm. Author.

1270. Effect of small amounts of certain colouring oxides on the colour of a soda-lime-silica glass. E. Preston and W. E. S. Turner. *J. Soc. Glass Technol.*, **25,** *pp.* 5–20(*T*), *Feb.*, 1941.—The extent to which the colouring oxides of Cr, V, Co, Ni, Mn, Cu and Ti can be tolerated in a standard soda-lime-silica glass of composition 73·5% SiO_2, 10% CaO and 16·5% Na_2O is determined by trial melts in Pt at 1400°C. in an electric furnace under slightly oxidizing conditions. Decolorizing tests using Se and Co oxide are carried out on the C_2O_3-containing glasses, and the spectral transmissions measured. It is found that glasses containing more than 0·002% Cr_2O_3 cannot be decolorized satisfactorily. When a glass containing 0·001% Cr_2O_3 is decolorized, further heating at the melting temperature, causing loss of Se, results in the re-development of the original colour more quickly than in the parallel case of a glass in which the original colour is due to Fe_2O_3. Ti up to 0·5% has no noticeable colouring effect on the glass or on the colour produced by 0·05% Fe_2O_3, and the decolorizing of the Fe_2O_3 was not affected. Vanadium was only $\frac{1}{30}$ as effective as Cr in producing a tint, and continued heating tended to remove that tint. Authors.

***1271. New quarter-wave compensator.** M. Richartz. *J. Opt. Soc. Amer.*, **31,** *pp.* 292–295, *April*, 1941.—A modified $\frac{1}{4}$-wave compensator is described. The chief feature of the new arrangement is the variable $\frac{1}{2}$-shade plate whereby the accuracy of measuring very small phase-differences is increased. The new compensator is especially useful to calibrate compensators of the variable-order type. AUTHOR.

1272. Projection of moving images on vaulted screens. U. GRAF. *Z. angew. Math. Mech.*, **20,** *pp.* 50–57, *Feb.*, 1940. *In German.*—On modern stages the background scene is thrown by a projector on a vaulted screen (round horizon). On shifting the diapositive the picture wanders over the screen, changing its size and form according to the vault of the screen. The author gives a theoretical and practical study of the possibilities of scenic effects resulting from this change and develops a method for making depositions producing a perspectively correct effect for all kinds of scenery. AUTHOR.

See also Abstract 1129.

SPECTROSCOPY.

1273. Spectrochemical analysis in agricultural research. L. H. ROGERS. *J. Opt. Soc. Amer.*, **31,** *pp.* 260–262, *March*, 1941.

1274. Spectroscopy in the vacuum ultra-violet. J. C. BOYCE. *Rev. Mod. Phys.*, **13,** *pp.* 1–57, *Jan.*, 1941.—A review dealing with the technique and results:—the transmission of gases, transmission of solids, reflecting power of gratings and mirrors ; photographic and spectrographic equipment ; light sources ; wave-length standards ; atomic spectra (emission and absorption) ; molecular spectra ; spectra of solids ; astrophysical and other applications. Principal absorption band heads in O_2 and N_2, wavelength standards, and a Bibliography of atomic spectra (arranging in order of increasing atomic number) are given. W. R. A.

***1275. Infra-red absorption cell for volatile liquids.** L. GILDART AND N. WRIGHT. *Rev. Sci. Instrum.*, **12,** *pp.* 204–205, *April*, 1941.—A simply constructed absorption cell with rocksalt windows is described which is capable of sealing against a pressure of 20 lb./in.^{2} The use of lead gaskets having surfaces amalgamated with Hg makes unnecessary the use of organic waxes or sealing agents. AUTHORS.

1276. Absorption spectra of ions of europium and the electric fields within some co-ordination compounds. S. FREED, S. I. WEISSMAN AND F. E. FORTESS. *J. Amer. Chem. Soc.*, **63,** *pp.* 1079–1085, *April*, 1941.—Because of the sharpness of their spectra the ions of Eu may be employed as spectroscopic indicators for the symmetry and for the intensity of the electric fields of their environment in solution as well as in crystals. The spectra of some chelate co-ordination compounds are described and from these are derived the symmetries of the fields about the central ions. AUTHORS.

1277. Near infra-red spectrum of water vapour. I. The perpendicular bands ν_2 and $2\nu_2$. H. H. NIELSEN. *Phys. Rev.*, **59,** *pp.* 565–575, *April* 1, 1941.—The rotation-vibration bands in the water vapour spectrum lying in the bolometric infra-red were completely remeasured. An analysis of the complicated rotational structure is carried out. From the interpretation of the data the value of the normal frequency and the anharmonic constant have been calculated as well as the values of the moments of inertia effective in these two vibration states. AUTHOR.

1278. Spectrophotometric study of characteristics of some halogen-substituted sulphonphthalein indicators. M. H. HARING AND H. A. HELLER. *J. Amer. Chem. Soc.*, **63,** *pp.* 1024–1027, *April*, 1941.

1279. Ultra-violet absorption spectrum of 1,3-cyclopentadiene. L. W. PICKETT, E. PADDOCK AND E. SACKTER. *J. Amer. Chem. Soc.*, **63,** *pp.* 1073–1077, *April*, 1941.—The ultra-violet absorption spectrum of 1,3-cyclopentadiene vapour between 32000 and 66000 cm.$^{-1}$ consists of a broad intense band with max. at 43000 cm.$^{-1}$ on which are superimposed narrow diffuse bands and a group of sharply defined narrow bands beginning at 50000 cm.$^{-1}$ Conclusions are drawn regarding the oscillator strength of the broad band. Analysis of the vibrational structure of the discrete bands reveals at least 2 band systems with 4 prominent vibrational frequencies comparable to the totally symmetrical frequencies observed in the normal molecule. The absorption spectra of solutions of cyclopentadiene and its dimer are measured. AUTHORS.

1280. The flame spectrum of CO. II. Application to afterburning. A. G. GAYDON. *Proc. Roy. Soc. A*, **178,** *pp.* 61–73, *May* 9, 1941.—It has been shown [Abstr. 106 (1941)] from a study of the spectrum of the CO flame that the molecules of CO_2 formed by the combustion are initially in a highly excited state of internal vibration. An attempt is made to derive approximate values for the lifetimes of these vibrationally activated molecules. The orders of magnitude of the radiative lifetime for the 3 types of vibration are derived, and the collision lifetimes are discussed with especial emphasis on the effect of moisture. A section is devoted to the possibility of the close resonance between the vibrations ν_1 and ν_2 of CO_2 resulting in a high percentage of dissociation after the combustion of the dry gas. The results give a good interpretation of the experiments of Garner on the marked effect of moisture and other catalysts on the infra-red emission of the flame, and go far towards explaining the latent energy of the combustion observed by David. The lifetime of the activated molecules is calculated to be not more than a few tenths of a second, but for moist gases the lifetime will be very much less, and the infra-red radiation from the flame and the latent energy of the products should be much reduced, in agreement with experiment. The vibrationally activated molecules are to be regarded as essentially normal molecules of CO_2 in which the vibrational energy has not had time to reach equipartition with the energy in other degrees of freedom. Experiments on the absorption spectrum of a long length of burning gas show strong absorption due to hot oxygen, particularly when the gases are dry. This is interpreted as being due to transfer of the vibrational energy from the CO_2 to the O_2 molecules, the absorption spectrum of which is thereby shifted to longer wavelengths.

AUTHOR.

1281. Anharmonicity of vibrations of polyatomic molecules. I. O. REDLICH. *J. Chem. Phys.*, **9**, *pp.* 298–305, *April*, 1941.—Several simplifying assumptions concerning the vibrational potential energy of polyatomic molecules are discussed and tested by means of the available experimental material. One of these assumptions furnishes relations between the higher coefficients of the potential energy of molecules containing several equivalent bonds. If a molecule contains p equivalent bonds XY, the potential energy of the corresponding symmetric stretching vibration, and only of this one, can be approximated by means of a Morse function with the constants pD and $a/\sqrt{p}$ in the place of D and a. The anharmonicity factors of bending vibrations are small if the third-order coefficient of the potential energy vanishes on account of the symmetry of the molecule.

AUTHOR.

1282. Normal vibrations of molecules with internal torsional motions. B. L. CRAWFORD, JR. AND E. B. WILSON, JR. *J. Chem. Phys.*, **9**, *pp.* 323–329, *April*, 1941.—The vibrational problem is treated for molecules consisting of a framework to which are attached any number of symmetrical tops, such as methyl groups. The vibrational problem can be separated from the internal torsional and overall rotation if the potential function is restricted so that the vibrational frequencies are independent of the torsion angles. The separation is effected by carrying out the normal co-ordinate treatment in the usual manner using the value zero for all force constants involving torsion angles. The frequencies will not depend on the particular equilibrium orientation assumed for the tops. Furthermore, the secular equation for the vibrational problem can frequently be factored to a greater extent than is indicated by the symmetry of the rigid molecule. The vibrational selection rules are also discussed and shown to be similar to those for normal molecules.

AUTHORS.

1283. Polar vibrations of alkali halides. R. H. LYDDANE, R. G. SACHS AND E. TELLER. *Phys. Rev.*, **59**, *pp.* 673–676, *April* 15, 1941.—These vibrations are discussed without making any specific assumptions about the detailed interactions between the ions. This is made possible by the introduction of the effective charge of an ion, defined as follows: All of the positive ions in a crystal slab are displaced by an equal amount in a direction perpendicular to the faces of the slab and all of the negative ions in the opposite direction. Then the effective charge is the ratio of the dipole moment per ion pair induced in the slab by this displacement to the relative displacement of the positive and the negative ions. Expressions are obtained for the frequencies of the longitudinal and of the transverse vibration in terms of the dielectric constant of the crystal, the dielectric constant obtained by extrapolating the square of the index of refraction of the crystal from high frequencies to zero frequency, and the effective charge. The ratio of the two frequencies is found to be independent of the effective charge.

AUTHORS.

1284. New absorption spectra of alkaline-earth fluorides. C. A. FOWLER, JR. *Phys. Rev.*, **59**, *pp.* 645–652, *April* 15, 1941.—Investigation under high dispersion reveals several new band systems in the ultra-violet region as far as λ 1 950. Vibrational analyses of these systems give the vibration frequencies and electronic terms of 1 new state of MgF, 3 of CaF, 4 of SrF and 4 of BaF. Some changes are made in the previous analyses of the $A \rightleftharpoons X$ system of MgF and the $C \rightleftharpoons X$ system of CaF. An increased binding in all of these higher energy states as indicated by the values of the constants is discussed with regard to the probable electron configurations.

AUTHOR.

1285. Systematics of band-spectral constants. VI. Interrelation of equilibrium bond constant and internuclear distance. C. H. D. CLARK AND K. R. WEBB. **VII. The empirical form of relations involving group number.** C. H. D. CLARK. *Trans. Faraday Soc.*, **37**, *pp.* 293–302, *June*, 1941.—Relations of the form $k_e r_e^x n^y = k_{qr}$, where k_e is equilibrium bond constant and r_e nuclear distance, n group number, and k_{qr} a sub-period constant, have been examined. It is found that with $x = 6$, $y = \frac{1}{2}$ or 1 good reproduction of present data is obtained, and the most suitable values of k_{qr} have been assigned. It seems probable that a value of y in the region $\frac{1}{2}$ to $\frac{2}{3}$ may ultimately be found most satisfactory. In the case of the diatom CC, the empirical data require $x = 5$. The results obtained compare favourably with those arising from suggestions made by other authors.

The potential function used by Linnett supports the relation with $x = 5$ and $y = \frac{1}{2}$ or $\frac{2}{3}$. Newing's recent work is shown to support the preferable form with $x = 6$ and to be consistent with the assumption that the repulsion term in the potential energy function is of the type ar^{-4}. AUTHORS.

1286. Intensity measurements in the molecular spectrum of hydrogen. N. GINSBURG AND G. H. DIEKE. *Phys. Rev.*, **59**, *pp.* 632–644, *April* 15, 1941.—The paper reports quantitative intensity measurements on the Fulcher bands. It appears that at the lower pressures no equilibrium exists and that therefore the concept of temperature has no meaning. By varying the pressure and current in the discharge tube the effective rotational temperature can be varied from 240° to 1 500°K. Whereas higher rotational states are favoured with an increase in pressure, the higher vibrational states are suppressed, and this effect is largely independent of the current. From the behaviour of the relative intensities with pressure and current density conclusions can be drawn regarding the elementary processes in the discharge. The results show that extreme care must be used when intensity measurements in band spectra are used for determining temperature. Apart from the fact that the conditions in the discharge tube may be far from equilibrium, the results obtained on the *P*- and *R*-branches show that the transition probabilities may be quite different, even in simple bands, from the values predicted by the elementary theory. AUTHORS.

1287. Far ultra-violet spectrophotometric studies of fatty acids by photo-electric and spectrographic methods. D. M. KERNS, R. BELKENGREN, H. CLARK AND E. S. MILLER. *J. Opt. Soc. Amer.*, **31**, *pp.* 271–279, *March*, 1941.—The calibration of a Littrow spectrograph for use between 2 800 and 2 000 Å is discussed with particular reference to the elimination and correction of scattered radiation. Quantitative absorption spectra for conjugated and non-conjugated alcohols, acids and esters, are given and the curves can be used to estimate quantitatively components in an unknown. A new fatty acid has been detected in liver lipids. W. R. A.

1288. Rotational isomerism in the alkyl halides. W. F. EDGELL AND G. GLOCKLER. *J. Chem. Phys.*, **9**, *pp.* 375–376, *April*, 1941.

1289. Vibrations of long-chain molecules; Raman spectra of *n*-octane, decane, cetane and eicosane in the liquid state. E. J. ROSENBAUM. *J. Chem. Phys.*, **9**, *pp.* 295–297, *April*, 1941.—The Raman spectra were photographed. With increasing chain length the low-lying Raman lines become few in number and very diffuse. This observation is interpreted in terms of a number of chain configurations co-existing in the liquid state in contrast to the extended configuration found by X-ray analysis of crystalline paraffins. Theoretical investigations which assume that the C atoms in a chain are coplanar are not applicable to data obtained for liquid (and gaseous) paraffins. AUTHOR.

1290. Infra-red and Raman spectra of polyatomic molecules. XIII. Nitromethane. XIV. Propylane. A. J. WELLS AND E. B. WILSON, JR. *J. Chem. Phys.*, **9**, *pp.* 314–322, *April*, 1941.—[See Abstr. 2654 (1940).] The infra-red spectrum of gaseous nitromethane was studied over the wavelength range from 3 to 25μ. The Raman work of Pendl, Reitz and Sabathy was checked. These data together with a partial normal co-ordinate treatment make an assignment of the observed lines and bands possible which accounts for all the fundamental frequencies except the torsion around the C – N bond.—The infra-red sprectrum of gaseous propylene was studied from 3 to 25μ with a spectrometer using fluorite, rock-salt and KBr prisms. A normal co-ordinate calculation of the fundamental frequencies was made, using force constants obtained principally from ethylene and ethane. This information, when combined with the known Raman spectrum, permits an assignment of 15 of the 20 fundamental frequencies and puts limits on 4 of the remaining frequencies. AUTHORS.

1291. Intensities of Stokes and anti-Stokes Raman lines in crystals. K. VENKATESWARLU. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 64–67, *Jan.*, 1941.

1292. Effect of temperature on the Raman spectrum of glycerine. A. L. S. RAO. *Indian Journ. Phys.*, **14**, *pp.* 365–367, *Oct.*, 1940.—The spectrum, being photographed, revealed 16 Raman lines. The line 674 becomes more diffuse at higher temperatures and increases in frequency by 20 cm.$^{-1}$ at 100°C. The 820 component accompanying the 850 line disappears at the higher temperature. These changes, which are similar to those with solution in water, are explained as due to depolymerization of glycerine complexes. AUTHOR.

1293. Frequency changes in the Raman spectrum of H_2SO_4. N. R. RAO. *Indian Journ. Phys.*, **14**, *pp.* 359–364, *Oct.*, 1940.—Changes in the frequency of the Raman lines of H_2SO_4 with dilution were measured. The l.f. bands 415 and 570 are shifted away from the Rayleigh line, and the 913 line shifts towards it, with increasing dilution. The 1 040 line first decreases in Raman frequency, and, on further dilution, its frequency is increased, while the 984 line remains unchanged. In solution of acid sulphate the 913, 1040 and 984 lines are of lower frequency than in an equivalent solution of H_2SO_4. Besides, all the lines are diffuse and broad in intermediate concentrations. The changes in the l.f. bands are attributed to changes in the relative abundance of H_2SO_4, HSO_4 and SO_4 radicals in solution with change in concentration. The behaviour of 913 is attributed to the relative abundance of H_2SO_4 and HSO_4 radicals, each of which contributes a component to this band. The 984 and 1040 lines owe their behaviour to the combined effects of ions, surrounding each of SO_4 or HSO_4 ions, and hydration. The lower frequency in the acid sulphate solution, as compared with the equivalent acid solution, is attributed to the predominance of hydration over the effect of surrounding ions, due to the smaller percentage of H ions in the former. AUTHOR.

1294. Association of acetic acid in non-aqueous solvents. P. KOTESWARAM. *Indian Journ. Phys.*, **14**, *pp.* 333–339, *Oct.*, 1940.—After a review of the work on acetic acid in water [Abstr. 3894 (1938)] the necessity for the study of this substance in non-aqueous solvents is stressed. Investigations were made with both polar and non-polar liquids as solvents. The changes in Raman frequencies in mixtures with chloroform, nitrobenzene, ethyl ether, acetone and methyl-ethyl ketone, are described. No changes are perceptible in solutions with chloroform. This is explained on the basis of the absence of either a donor or an acceptor atom in this solvent, which is therefore supposed not to have any influence on the acid. The other 4 substances bring about distinct shifts in the $C = O$ frequency. This is attributed to the presence of the donor atom O in these molecules, which is in a position to associate with the acceptor H in the acid molecules. Such an association can bring about the splitting of the associated molecules of the acid also, which therefore results in the change of the Raman frequencies of the acid. A new line with frequency 1 760 cm.$^{-1}$ is ascribed to the free $C = O$ bond in the acid which arises out of the disruption of the acid complexes into simpler molecules and which remains free in the new complex formed with the solvent. AUTHOR.

1295. Molecular association in acetone and methyl-ethyl ketone. P. KOTESWARAM. *Indian Journ. Phys.*, **14**, *pp.* 341–351, *Oct.*, 1940.—The Raman spectrum of acetone is studied in different solvents : water, methyl alcohol, phenol and acetic acid at different concentrations. In all these cases the $C = O$ line of acetone is found to shift towards smaller frequencies, while its $C - C$ line and some of the deformation frequencies are found shifting towards higher frequencies. In acetic acid a new line at 1 760 cm.$^{-1}$ is obtained. These results are explained on the basis of the formation of hydrates in water and complexes between the acetone molecules and those of the solvent in which it is dissolved. While these solvents produce such conspicuous changes, non-polar solvents like benzene and carbon-tetrachloride and normal polar solvents like ether and chloroform do not produce any effect on the Raman spectrum of acetone. This acetone seems to associate only with molecules having an acceptor atom. Similar results obtained with methyl-ethyl ketone are similarly explained. AUTHOR.

1296. Molecular association as studied by Raman effect. P. KOTESWARAM. *Indian Journ. Phys.*, **14**, *pp.* 353–357, *Oct.*, 1940.—From a study of molecular association between similar and dissimilar molecules in a number of liquids and their mixtures certain general conclusions are drawn as to the case of molecular association. It has been found that, for association between 2 molecules, 1 must have a donor atom and the other an acceptor. Mere polar nature of a molecule does not facilitate association. The extent of depolymerization of liquids on mixing is also investigated. AUTHOR.

1297. Raman spectrum of gypsum. B. D. SAKSENA. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 25–32, *Jan.*, 1941.—The spectra of a single crystal of gypsum are obtained in various orientations, and the state of polarization of some of the lines is studied. Four new lines at 80, 125, 585 and (1 065), have been obtained besides the lines 175 and 315 reported by Nisi. Spectra of gypsum have also been obtained with incident light polarized along OZ, the symmetry axis being along OY, the direction of observation. The polarization studies and the results obtained with polarized incident light completely satisfy the selection rules for a monoclinic crystal. This makes it possible to classify the lines 415, 492 and 1 006, as totally symmetric vibrations and 618, 672 and 1 136, as antisymmetric. AUTHOR.

***1298. Precision direct-reading spectrophotometer.** A. L. NARAYAN AND C. K. ANANTHASUBRAHMANYAM. *Indian Journ. Phys.*, **14**, *pp.* 393–399, *Oct.*, 1940.—The experimental errors inherent in photographic photometry are discussed and a direct-reading spectrophotometer for the visible, especially adapted to the study of line contour and absorption and fluorescence spectra, is described. Because of the higher resolution of which it is capable the method permits a more precise and complete analysis of absorption and fluorescence spectra by revealing the fine structure too small to be detected by the usual methods. A test of the instrument was carried out by determining the intensities of the lines 4 078 and 4 047 from the Hg arc and the energy distribution in the Hβ of the solar spectrum. The system is distinguished by high sensitivity and easy adjustment and it dispenses with the labour involved in photographic photometry. AUTHORS.

TRANSMISSION.

1299. Final measurements of the velocity of light. W. C. Anderson. *J. Opt. Soc. Amer.*, **31**, *pp.* 187–197, *March*, 1941.—Improvements in the apparatus formerly used include the use of an 11-stage electron multiplier tube, the control of the transmitter frequency by the laboratory standard, the substitution of a 1 000 W water-cooled Hg arc for the light source, a new type of Kerr cell, changes in the mirror supports and base line measurements, and the use of an automatic recorder. The apparatus has been completely rebuilt and converted to a.c. operation. The optical system has been changed to permit simpler measurements of the path difference, and electrical circuits have been devised to smooth out the fluctuations due to voltage variations and other causes. Group velocity is discussed as a correction factor in this and previous measurements. The correction is shown to amount to as much as 7 km./sec. in some cases. Electron transit time is shown to be a limiting factor. The final result of 2 895 observations is given as 299 776 ± 14 km./sec. This includes a group velocity correction. Author.

VISION.

1300. Visibility and seeing. M. Luckiesh and F. K. Moss. *J. Franklin Inst.*, **231**, *pp.* 323–343, *April*, 1941.—The paper discusses the meaning of visibility and the methods available for measurement, in particular with the Luckiesh-Moss visibility meter. The authors describe the results of their measurements of the ease of seeing in terms of the rate of blinking and find that, in general, the rate of blinking varies conversely with the visibility of the task, such as reading. The importance of measuring visibility is stressed, particularly for the actual conditions of observation and not in terms of threshold conditions. W. D. W.

1301. Colour vision and the autonomic nervous system. S. V. Kravkov. *J. Opt. Soc. Amer.*, **31**, *pp.* 335–337, *April*, 1941.—Quite different indirect stimuli often produce similar changes in the colour sensitivity of the eye. It was assumed that this similarity of effect is due to all these indirect stimuli being similar in their influence upon the autonomic nervous system. Direct experiments with instillation of adrenalin and pilocarpin into the eye have shown that colour sensitivity does change when affected by these sympathico- and parasympathico-mimetic substances. In the light of the dependence of colour vision on the autonomic nervous system it is also possible to account for the seasonal fluctuations of colour sensitivity recently described in special papers. Author.

1302. The bases of colour vision. L. H. Hardy. *Illum. Engng, N.Y.*, **36**, *pp.* 295–310 ; *Disc.*, 310–312, *March*, 1941.—A brief discussion of the physical, anatomical, physiological and psychological bases upon which colour vision is dependent. Light, its nature, origin, location in the electromagnetic spectrum, components and sources, is briefly discussed. The gross anatomy and physiology of the eye, absorption curves of the ocular media, histological and physiological data concerning the photoceptors and some considerations regarding the reaction of light upon these receptors, are given in summary. A final short note on some psychological factors involved in colour vision is presented. Author.

1303. Psychological aspects of colour measurement. H. J. Eysenck. *Nature, Lond.*, **147**, *pp.* 682–683, *May* 31, 1941.—Experiments are described to test the validity of certain claims advanced for the Ostwald system of colour specification. The observer was asked to space out a series of greys so that their distance apart corresponded to the subjective difference between them. Similar observations were made for colour and tests were also carried out on colour harmony. The results showed that the spacing of the Ostwald colours was not in accordance with the claims made for them, but it was believed that the main aims which Ostwald hoped to reach were eminently worth while. W. D. W.

X-RAYS.

1304. Diffuse scattering of X-rays by rocksalt. R. Q. Gregg and N. S. Gingrich. *Phys. Rev.*, **59**, *pp.* 619–621, *April* 15, 1941.—A monochromatic Laue pattern of rocksalt has been obtained with crystal-reflected Mo $K\alpha$ radiation and shows 40 diffuse spots. The positions of these spots, their intensities and their half-widths at half-max., are compared with values for these quantities predicted by Zachariasen. In general, the agreement is good. Authors.

1305. Measurement by ionization methods of real energy absorption from an X-ray beam. J. R. Clarkson. *Phil. Mag.*, **31**, *pp.* 437–451, *June*, 1941.—Ionization currents were measured at low pressures in various gases contained in chambers having walls of several different metals as well as of graphite and of Elektron alloy. The X-radiation comprised only a narrow range of wavelengths. It is shown that the electronic real energy absorption coefficients as measured from the slopes of the ionization-pressure curves are less than those obtained from theoretical considerations, except for substances of low atomic number (< 12). Author.

1306. Applications of X-ray diffraction methods in industrial chemistry. C. W. Bunn. *J. Sci. Instrum.*, **18**, *pp.* 70–74, *May*, 1941.—Several examples of the use of X-ray diffraction patterns in industrial chemical problems are mentioned. The results include the identification of the constituents of bleaching powder, the explanation of the variable colours of certain precipitated iron oxide pigments as a consequence of the polymorphism of FeO(OH), the identification of boiler scale constituents with known mineral species, a study of the crystallography of the hydrated calcium aluminates and of calcium sulphate sub-hydrate (hitherto known as hemihydrate), the quantitative analysis of mixtures of polymorphous crystal forms, the determination of crystal size in the range below 10^{-5} cm., and the discovery of the molecular structure of plastics. AUTHOR.

1307. Application of X-ray methods to the determination of phase-boundaries in metallurgical equilibrium diagrams. W. HUME-ROTHERY AND G. V. RAYNOR. *J. Sci. Instrum.*, **18**, *pp.* 74–81, *May*, 1941.—The relative advantages of the X-ray and classical methods for the determination of phase boundaries in metallurgical equilibrium diagrams are discussed. For ordinary equilibrium diagram work at the higher temperatures the classical methods appear more satisfactory and reliable, but the X-ray methods become increasingly valuable at the lower temperatures, provided that sufficiently long periods of annealing are used. The X-ray methods are of the greatest value in alloys in which superlattice transformations are involved. The difficulties of determining the composition of the filings comprising the X-ray specimen are emphasized, and also the dangers likely to arise from decomposition of filings during quenching. The general conclusion drawn is that the X-ray and classical methods should be used in conjunction, and that it is a mistake to rely on X-ray methods alone. AUTHORS.

1308. Applications of X-ray analysis methods to steel-works' problems. A. H. JAY. *J. Sci. Instrum.*, **18**, *pp.* 81–84, *May*, 1941. [Abstr. 794B (1941)].

1309. Applications of the X-ray powder method in industrial laboratory problems. H. R. ROOKSBY. *J. Sci. Instrum.*, **18**, *pp.* 84–90, *May*, 1941.—Some aspects of the experimental technique are discussed, and the examples have been chosen to emphasize the diverse character of the problems which can be investigated. The suitability of certain refractory materials for use in glass-melting tanks is indicated by particular features of the X-ray diffraction patterns. The examination of the thermionically active coatings for the cathodes of radio receiving valves is described, and the value of X-ray methods in the study of inorganic luminescence is indicated. Examples of a metallurgical nature include the examination of Ni-Fe powders for loading and radio cores, of lattice distortion in tungsten, and of directional orientation in rolled sheet. AUTHOR.

1310. Study of carbon by the Debye-Scherrer method. A. TAYLOR. *J. Sci. Instrum.*, **18**, *pp.* 90–94, *May*, 1941.—The technique of taking Debye-Scherrer photographs of various modifications of carbon using standard 9 cm. and 19 cm. cameras of the Bradley type is described. The method of using the curves from a manually operated null-deflection microphotometer of the Dobson type to calculate the crystallite dimensions of the carbons is explained, in which a new definition of line broadening is used. The variations in crystallite dimensions of different carbons calculated on the new basis are included. A brief account is given of the advantages of using the 19 cm. dia. camera to show details which are completely lost when the 9 cm. dia. camera is used. AUTHOR.

1311. X-ray examination of mechanical wear products. H. J. GOLDSCHMIDT AND G. T. HARRIS. *J. Sci. Instrum.*, **18**, *pp.* 94–97, *May*, 1941. [Abstr. 795B (1941)].

1312. Industrial testing of materials by X-ray diffraction. J. A. DARBYSHIRE. *J. Sci. Instrum.*, **18**, *pp.* 99–100, *May*, 1941. [Abstr. 796B (1941)].

1313. Identification of clay minerals by means of aggregate X-ray diffraction diagrams. G. NAGELSCHMIDT. *J. Sci. Instrum.*, **18**, *pp.* 100–101, *May*, 1941.—By allowing clay suspensions to evaporate slowly on a flat surface, specimens are obtained in which the particles are mainly oriented with their basal planes parallel to the plane of sedimentation. The basal spacing reflections obtained from such specimens with an X-ray spectrometer can be identified with more certainty than those obtained from X-ray powder diagrams. This is important as the basal spacings are the best characteristics for differentiating between various clay minerals or groups of such minerals, especially if several of them occur in a mixture and their grain-sizes are small. AUTHOR.

1314. Interesting changes of physical condition in a piece of tungsten. F. BRECH. *J. Sci. Instrum.*, **18**, *pp.* 101–102, *May*, 1941. [Abstr. 915B (1941)].

1315. Continuous X-rays excited by the β-particles of $_{15}P^{32}$. CHIEN-SHIUNG WU. *Phys. Rev.*, **59**, *pp.* 481–488, *March* 15, 1941.—The intensity of the internal X-rays excited by the disintegration electrons when leaving the nucleus was found by the extrapolation method to be approximately equal to ¼ of that of external X-rays excited by completely stopping the electrons in Al. From the experimental data the total energies of the two radiations were estimated. The relation between the intensity of the external X-rays excited by completely stopping electrons in Pb, W, Sn, Ag, Mo, Cu, Fe, Al, C and Be, and the atomic number was investigated. It was found to be in fairly good agreement with the theoretical curve derived according to Bloch's formula for energy loss of electrons by inelastic collisions. [Abstr. 2045 and 2606 (1933)]. AUTHORS.

HEAT.

CALORIMETRY.

1316. Heats of dilution, relative molal heat contents and heat capacities of aqueous Na_2SO_4. solutions. W. E. WALLACE AND A. L. ROBINSON. *J. Amer. Chem. Soc.*, **63**, *pp.* 958–963, *April*, 1941.

1317. Specific heat of the NaCl crystal. E. W. KELLERMANN. *Proc. Roy. Soc. A.*, **178**, *pp.* 17–24, *May* 9, 1941.—About 280 previously calculated proper frequencies of the NaCl lattice are used to determine the sp. ht. of NaCl according to Born's theory. It is shown that this number of frequencies is sufficiently large to make possible the determination of the frequency distribution and, therefore, of the sp. ht. Agreement with experiment is obtained. It is shown, in agreement with Blackman's investigations, that the deviations from Debye's theory as found experimentally are due to Debye's assumption of a ν^2 law for the frequency distribution instead of the distribution following from the atomic theory. AUTHOR.

1318. Specific heats at low temperatures of crystalline boric oxide, boron carbide and silicon carbide. K. K. KELLEY. *J. Amer. Chem. Soc.*, **63**, *pp.* 1137–1139, *April*, 1941.—The measurements extended over the temperature range 51° to 298°K. AUTHOR.

1319. Heat capacities of some organic compounds containing nitrogen and the atomic heat of nitrogen. II. S. SATOH AND T. SOGABE. *Sci. Pap. Inst. Phys. Chem. Res., Tokyo, Nos.* 1012–1014, *pp.* 231–251, *March*, 1941.

1320. Thermal data on organic compounds. XXI. Heat-capacity, entropy and free-energy data for the four methylnonanes. G. S. PARKS, T. J. WEST AND G. E. MOORE. *J. Amer. Chem. Soc.*, **63**, *pp.* 1133–1135, *April*, 1941.—The specific heats of the 4 methylnonanes were measured between 80° and 298°K., and the corresponding heats of fusion are determined. The entropies in the liquid state at 298·16°K. are calculated from the heat-capacity data. The corresponding free energies of the 2-methylnonane and 5-methylnonane are also calculated. These are lower than the free energy of *n*-decane by 1 490 and 1 300 cal., respectively. AUTHORS.

1321. Heat technology. II. W. MEISSNER AND T. SCHINNERER. *Phys. in regelmäss. Ber.*, **7**, 3, *pp.* 89–105, 1939. *In German.*—The report covers the publications between the middle of 1934 and the end of 1938. The development concerns mainly specific heat, enthalpy and entropy of gases, heat radiation, heat transfer, temperature of rapidly flowing gases, improvements in the use of high-pressure steam (up to and above 100 atm.), use of condensed and compressed gases in i.c. engines, etc. The report deals with general questions, steam generation and steam engines, explosion and combustion engines and temperature regulators, and gives a Bibliography of 174 publications. [See Abstr. 518B (1935)]. R. N.

CONDUCTION.

1322. Steady flow of heat from certain objects buried under flat air-cooled surfaces. F. H. SCHOFIELD. *Phil. Mag.*, **31**, *pp.* 471–496, *June*, 1941.—A general method of estimating the steady flow of heat from, and the temperature distribution around, objects buried under flat air-cooled surfaces is developed for a considerable class of 2-dimensional problems. By this method an approx. solution of the problem is at once derived from the simpler solution of the corresponding problem in which the sink of heat, instead of being, as required, a surface subject to Newton's law of cooling, is an isothermal surface. A critical examination of the method is made, with satisfactory results, in 3 practical cases : (1) A pipe or cable buried in the ground ; (2) the same in a wall ; (3) a girder or ship's rib projecting into a wall. AUTHOR.

CONVECTION.

1323. Heat transfer by organic fluids. M. H. LEWIS AND D. W. RUDORFF. *Engineering*, **151**, *pp.* 261–264, *April* 4, 1941.—Ten years' practical experience has shown that diphenyl and diphenyl compounds can be used at high temperatures as heat transfer agents. Dowtherm A, a chemical mixture of 73·5% diphenyloxide and 26·5% diphenyl, can be satisfactorily used up to 750°F., at which temperature the saturation pressure amounts to only 150 lb./in². Thermal properties of these fluids are given as well as descriptions of actual plants in which they have been employed. Their main application is as heat-carrying agents

in industrial process-heating schemes for temperatures ranging from 400° to 750°F., particularly for processes where close temperature regulation of the heating medium is required. At higher temperatures (up to 1 506°F.) use of a mixture of ammonium, sodium and iron chlorides is possible if the fluid is kept out of contact with air and water.
R. W. P.

FUSION AND SOLIDIFICATION.

✱**1324. Design of hydrogen liquefiers.** C. Starr. *Rev. Sci. Instrum.*, **12,** *pp.* 193–198, *April*, 1941.—The general principles underlying the practical design of Joule-Thomson hydrogen liquefiers, utilizing the compressed hydrogen commercially available in cylinders, are discussed. The theory of heat interchangers is applied to these liquefiers, and design formulae and data are presented. A typical design for the regenerative interchanger of a small-scale liquefier is described. The liquid-nitrogen requirements, expansion-valve design, charcoal trap construction and other practical aspects of these liquefiers, are also discussed.
Author.

TEMPERATURE.

✱**1325. New type of pyrometer for measuring gas temperatures.** A. Blackie. *J. Sci. Instrum.*, **18,** *pp.* 113–115, *June*, 1941.—The type of pyrometer consisting of a number of thermocouples of different thicknesses is examined with a view to establishing a system whereby the true temperature of a flowing gas can be ascertained by a single reading. The conditions having been established, the practical difficulties of design are considered and means suggested for minimizing them. The case of a resistance thermometer for measuring gas temperatures is then considered and the proposed circuit diagram for such an instrument described.
Author.

THERMOCHEMISTRY.

1326. Activity coefficients of Li_2SO_4, Na_2SO_4, K_2SO_4 and $Na_2S_2O_3$ at 25°C., from isopiestic vapour pressure measurements. R. A. Robinson, J. M. Wilson and R. H. Stokes. *J. Amer. Chem. Soc.* **63,** *pp.* 1011–1013, *April*, 1941.

1327. Temperature and latent energy in flame gases. W. T. David. *Engineer, Lond.*, **171,** *pp.* 268–270, *April* 25, 1941.—An account of experiments which are considered to indicate the existence of a long-lived latent energy in flame gases. As a result of this latent energy the ideal calculated flame-gas temperature is not usually attained, nor is the calculated pressure fully attained when an explosion occurs in a closed vessel, the departure being greater the smaller the vessel. The abnormal molecules which give rise to this latent energy are thought to become normalized when the flame gases come into contact with a surface, and an experiment is described which can be interpreted as confirming such a disappearance of latent energy.
R. W. P.

See also Abstracts 1280, 1321.

THERMODYNAMICS.

✱**1328. New method for the determination of "J"** A. G. Chowdri and D. S. Kothari. *Indian Journ. Phys.*, **14,** *pp.* 409–413, *Oct.*, 1940.—The paper describes a modification of Laby and Hercus's method. The rotating magnetic field is replaced by a non-rotating magnetic field. The angular velocity in Laby's method corresponds to a factor RX/L, where R is the resistance, L the self-inductance and X is a length.
Authors.

1329. Thermodynamic properties of gypsum and its dehydration products. K. K. Kelley, J. C. Southard and C. T. Anderson. *Tech. Pap. U.S. Bur. Min.*, No. 625, [73 *pp.*], 1941.

1330. Thermodynamic functions of C_3O_2. H. W. Thompson. *Trans. Faraday Soc.*, **37,** *pp.* 249–251, *May*, 1941.—From available spectroscopic and structural data values are calculated and tabulated in the range 279° to 1 000°K. for total translational plus rotational entropy, vibrational entropy, free energy function and total heat content.
N. M. B.

1331. Thermodynamic functions and equilibria of formaldehyde, deuteroformaldehyde, phosgene and thiophosgene. H. W. Thompson. *Trans. Faraday Soc.*, **37,** *pp.* 251–260, *May*, 1941.—The entropy, free energy, heat content and sp. ht., of formaldehyde and deuteroformaldehyde have been calculated over a wide range of temperature. The results are correlated with measurements on the equilibria $H_2 + CO \rightleftharpoons H_2CO$ and $H_2 + H_2CO \rightleftharpoons CH_3OH$. The free energy of formation of formaldehyde between 300°–1 500° K. is calculated. Values are obtained for the corresponding thermodynamic functions of thiophosgene and phosgene for temperatures 300°–1 000°K. In the latter case the calculated free energies were used to calculate the equilibrium constant of the reaction $CO + Cl_2 \rightleftharpoons COCl_2$ over a range of temperature. Comparison of the calculated values with those determined experimentally suggests a better value for the heat of formation of phosgene than that previously assumed. The significance of various possible errors in the calculations are discussed.
Author.

1332. Pressure-volume-temperature relations in solutions. V. Energy/volume coefficients of carbon tetrachloride, water and ethylene glycol. R. E. Gibson and O. H. Loeffler. *J. Amer. Chem.*

Soc., **63**, *pp.* 898–906, *April*, 1941.—From new measurements of sp. vol. at 25°C., thermal expansions and compressions, a table is compiled of the volumes at any temperature and pressure in the range 25° to 65°C. and 1 to 1 000 bars for carbon tetrachloride and in the range 25° to 105°C. and 1 to 1 000 bars for ethylene glycol. A similar table covering the range 25° to 85°C. and 1 to 1 000 bars is compiled for water, older values of the expansions and new measurements of the compressions being used. Suitable equations for computing the first and second derivatives are given, the Tait equation being used for the pressure/volume relations. The thermal expansibilities, the compressibilities, the pressure/temperature coefficients, the energy/volume coefficients (C_P–C_V) and other related properties, are computed. [See Abstr. 725 (1941)]. AUTHORS.

1333. Structural mechanics of highly elastic continua. IV. Piezometry of inner friction. H. UMSTÄTTER. *Kolloid Zschr.*, **92**, *pp.* 169–179, *Aug.*, 1940. *In German.*—A relation between viscosity and pressure may be obtained by substituting the time co-ordinate in Maxwell's stress equation by corresponding quantities of supersonics [Abstr. 2591 (1940)]. The relation is verified by previous measurements. For every liquid a characteristic value of inner pressure can be derived which is a certain multiple of the surface tension and represents the tensile strength of the liquid. This is formally related to an equation given by Eötvös, and an equation of state for liquids may be theoretically established by Thomson's equation for the increase of v.p. at surfaces with strong curvature. As the equation of state contains the mol. wt. the latter may be determined from viscosity/temperature and viscosity/pressure curves. But the use of this somewhat complicated method is only advisable for lyophil colloids for which osmotic methods are not applicable. R. N.

See also Abstracts 1320, 1321.

VAPORIZATION AND CONDENSATION.

∗1334. Determination of the vapour-pressure curve of liquid helium below 1.6°K., using a magnetic thermometer. B. BLEANEY AND R. A. HULL. *Proc. Roy. Soc. A*, **178**, *pp.* 74–85, *May* 9, 1941.—The v.p. curve is determined using the susceptibility of various paramagnetic salts as the thermometer. It is found that the results agree with the curve recently calculated by Bleaney and Simon to within the experimental error of 0·004 deg. down to 1°K., and differ slightly from the scale 1937 of Schmidt and Keesom. AUTHORS.

ACOUSTICS.

1335. Optical method for the measurement of ultrasonic absorption. E. C. GREGG, JR. *Rev. Sci. Instrum.*, **12**, *pp.* 149–151, *March*, 1941.—The absorption coefficients of various liquids were determined by measuring the voltage which must be applied to the vibrating crystal in order to bring the points of convergence of parallel light into focus in a microscope set at various distances down the sound beam. As was expected from theory, a linear relationship appeared between the log of the voltage and the distance of the light beam from the radiator along the sound beam. The absorption was measured as a function of the slope of this line. AUTHOR.

See also Abstracts 1143, 1151.

ELECTRICITY AND MAGNETISM.

CONDUCTION AND DISCHARGE IN GASES.

1336. Influence of a longitudinal magnetic field on electric discharge in mercury vapour at low pressure. C. S. CUMMINGS AND L. TONKS. *Phys. Rev.*, **59**, *pp.* 514–522, *March* 15, 1941.—The effect of a uniform longitudinal magnetic field on a low-pressure arc was investigated in an arc tube with a Hull-type cathode and movable and fixed probes. The magnetic field collimated the current flow from the cathode into a luminous beam which disappeared rather abruptly 30 cm. from the cathode into a tube-filling glow. This glow was more intense at the axis than in the absence of field. By making the field more intense at the cathode the beam was made to fill the tube and the subsequent glow was indistinguishable from that observed in the absence of field. It thus appeared that a uniform field exercised no constrictive effect on the arc. Distortion of the probe characteristics by the field limited the range within which the probes could be used to low field values at which interesting magnetic effects were still weak. The field imparted a transverse stiffness to the arc which caused the transmission of a disturbed condition over large distances in the direction of electron flow. The measurements showed that there was no marked change in electron temperature, gradient, or electron concentration in the presence of a field and indicated that the limiting cross-sectional distribution of charge as transmitted disturbances die out is the same as in the absence of field. The change of transverse potential distribution with field was found to be roughly in accordance with the modified Boltzmann distribution for the electrons which was previously derived theoretically. Authors.

1337. Joint action of diffusion and recombination of ions. G. Jaffé. *Phys. Rev.*, **59**, *pp.* 652–658, *April* 15, 1941.—The differential equation which describes this action is solved for the 1-dimensional case by a method previously developed [Abstr. 2565 (1929)]. The decay of a given initial distribution of ions is treated. The observable coefficient of recombination, as modified by diffusion, depends strongly in the initial stage on the given distribution. For later times it depends in a simple way on the density of ionization and the distance between the collecting plates. The establishment of the steady state, with constant production of ions, is calculated. Diffusion introduces a linear term which, for sufficiently small values of the ionic density and the electrode distance, may mask the usual quadratic term. It is shown that anomalies observed by Gardner in the recombination coefficient of oxygen and by Power in the establishment of the steady state in air are explained, without further assumptions, by diffusion to the walls. Author.

1338. Relation between electric and spectroscopic characteristics in low-pressure discharges. C. G. Found and E. F. Hennelly. *Illum. Engng, N.Y.*, **36**, *pp.* 400–410, *March*, 1941.—Develops a theoretical formula for the intensity of the resonance radiation in a low-pressure mercury discharge tube, involving the concentration of atoms, the concentration of electrons, the tube radius and the probability of excitation. Experimental tubes of different sizes were constructed as described in the paper and the results obtained on these are compared with those to be expected on the theory. It is shown that the production of radiation is controllable, given sufficient information regarding the electrical characteristics. J. W. T. W.

CONDUCTION IN SOLIDS AND LIQUIDS.

1339. Ionization constants of oxalic acid at 25°C., from conductance measurements. L. S. Darken. *J. Amer. Chem. Soc.*, **63**, *pp.* 1007–1011, *April*, 1941.—The conductance method has been adapted to the determination of the ionization constants of oxalic acid. The limiting equivalent conductance of sodium oxalate was found to be 124·25, and the conductance corresponding to the primary ionization of oxalic acid was found to be 390·0. Author.

1340. Magnitude of the surface conductivity at aqueous/glass interfaces. H. L. White, F. Urban and B. Monaghan. *J. Phys. Chem.*, **45**, *pp.* 560–573, *April*, 1941. [Abstr. 812B (1941)].

See also Abstract 1104.

DIELECTRICS AND CAPACITANCE.

1341. Induction and dipole moment in chloro- and nitroparaffins. R. H. Wiswall, Jr. and C. P. Smyth. *J. Chem. Phys.*, **9**, *pp.* 356–361, *April*, 1941.—The dielectric constants of the vapours of the butyl chlorides, methyl chloroform, nitromethane, α- and β-nitropropane and 2-methyl-2-nitropropane, were measured over a range of temperature and pressure and used to calculate the dipole moments of the molecules of these substances. The moments found for α- and β-nitropropane and 2-methyl-2-nitropropane are indistinguishable from one another but are slightly larger than that of nitromethane. Examination of the molecular models shows that the moment differences found are approximately those to be expected from the inductive effects, with the exception of the large difference between chloroform and methyl chloroform where induction is a major cause of the difference. Authors.

***1342. Measurement of the dielectric constants of vapours and the polarization of trimethylaluminium, dimethylaluminium chloride and methylaluminium dichloride.** R. H. Wiswall, Jr. and C. P. Smyth. *J. Chem. Phys.*, **9**, *pp.* 352–356, *April*, 1941.—Modifications of an apparatus for the measurement of the dielectric constants of vapours are described. The accurate calculation of the dipole moments of the molecules is prevented by strong molecular association. The data indicate a probability that the single trimethylaluminium molecule has a pyramidal structure and that the Al-C bond is predominantly covalent. Authors.

1343. Dielectric properties of resin-oil mixtures. J. B. Whitehead and J. J. Chapman. *J. Franklin Inst.*, **231**, *pp.* 245–267, *March*, 1941. [Abstr. 804B (1941)].

1344. Dispersion and absorption in dielectrics. I. A.C. characteristics. K. S. Cole and R. H. Cole. *J. Chem. Phys.*, **9**, *pp.* 341–351, *April*, 1941.—The dispersion and absorption of a considerable number of liquid dielectrics are represented by the empirical formula

$$\epsilon^* - \epsilon_\infty = (\epsilon_0 - \epsilon_\infty)/[1 + (i\omega\tau)^{1-\alpha}].$$

In this equation ϵ^* is the complex dielectric constant, ϵ_0 and ϵ_∞ are the static and infinite-frequency dielectric constants, $\omega = 2\pi \times$ frequency, and τ_0 a generalized relaxation time. The parameter α can assume values between 0 and 1, the former value giving the result of Debye for polar dielectrics. The expression requires that the locus of the dielectric constant in the complex plane be a circular arc with end points on the real axis and centre below this axis. If a dielectric is represented by a 3-element electrical circuit, the mechanism responsible for the dispersion is equivalent to a complex impedance with a phase angle which is independent of the frequency. On this basis the mechanism of interaction has the striking property that energy is conserved or stored in addition to being dissipated and that the ratio of the average energy stored to the energy dissipated per cycle is independent of the frequency. Authors.

1345. Effect of an electric field of strength $-\frac{1}{2}aF^2$ on the polarizability constant of the normal H atom. W. H. Robinson. *Indian. Journn. Phys.*, **14**, *pp.* 405–408, *Oct.*, 1940.—It is shown mathematically that an electric field of strength $-\frac{1}{2}aF^2$ gives a negative polarizability coefficient, a, of $-0{\cdot}58947 \times 10^{-24}$ cm^3., a value in close agreement with that obtained by the application of the first- and second-order perturbation theory to the Stark effect of the H atom by Epstein *et al.* A. J. M.

1346. Electrical conductivity of plastic dielectrics. A. Gemant. *Phil. Mag.*, **31**, *pp.* 405–412, *May*, 1941.—The paper is concerned with ionic mobility in vitreous dielectrics, which generally exhibit a finite plasticity. The fundamental idea is to deal with the deformation as caused by the motion of an ion in the same way as macroscopic deformations of plastics are dealt with. This latter can be described by means of 3 constants of the material, namely plasticity, elasticity and solid friction, and the same should hold for the molecular deformation around a moving ion. In the case of d.c. the current/voltage characteristic can be calculated. This is done for paraffin wax up to a field of 150 kV/cm. The curve shows the same features as measurements on paraffin by Scislowski. For an a.c. voltage the loss angle can be calculated from the theory. This is done for soda glass, based on solid-friction data of Gemant and Jackson, Bennewitz and Rötger, and Wegel and Walther between 10^{-1} and 10^5 c./s. Another calculated curve shows the temperature variation of the loss angle of lead glass between 20° and 140°C. The results are consistent with experimental data on the dielectric loss of glasses obtained by Strutt.

Author.

1347. Thallous-chloride/ethanol/water system at 25°C. Activity coefficients of thallous chloride in ethanol/water mixtures. E. Hogge and A. B. Garrett. *J. Amer. Chem. Soc.*, **63**, *pp.* 1089–1094, *April*, 1941.—The solubility of thallous chloride is determined in alcohol/water mixtures of 10%, 30%, 40%, 50% and 60% alcohol by wt. and with added KCl. The densities of these solutions are given. From these data the activity coefficients of thallous chloride in each of the solvents are calculated over a range of ionic strength. A correction for incomplete dissociation is applied to the measurements. The behaviour of thallous chloride as a function of the dielectric constant is compared with the predictions of the Born relation and found to conform as regards the order of magnitude but to show deviations from the theory which increase as the dielectric constant decreases. Authors.

See also Abstracts 1112, 1267.

ELECTROCHEMISTRY.

1348. Reduction of oxygen at the dropping mercury electrode. I. M. Kolthoff and C. S. Miller. *J. Amer. Chem. Soc.*, **63**, *pp.* 1013–1017, *April*, 1941.

1349. Sb electrode. I. Normal electrode potential. II. Potential of Sb electrode as function of pH. F. Hovorka and G. H. Chapman. *J. Amer. Chem. Soc.*, **63**, *pp.* 955–957, *April*, 1941.—Very satisfactory Sb electrodes were obtained by electrolysis of pure Sb from HF solution. The Sb so obtained was cast into sticks under reduced pressure. The resulting castings, which were free from surface pits and had a high lustre, were cleaned by electrolysis in a Na_2CO_3 solution and repolished before use. Authors.

1350. Activity coefficient of hydriodic acid at 25° from isopiestic vapour pressure measurements. H. S. Harned and R. A. Robinson. *Trans. Faraday Soc.*, **37**, *pp.* 302–307, *June*, 1941.—The results are fitted to 2 forms of the extended Debye-Hückel equation. These activity coefficients and the e.m.f. data of Pearce and Fortsch lead to a value of $E^\circ = 0{\cdot}1517$ V for the Ag/AgI electrode, compared with 0·1522 V from other measurements. The free-energy changes of some hydrogen-iodine reactions are discussed. A value of $E^\circ = 0{\cdot}5352$ V has been computed for the standard potential of the $I_2 - I^-$ electrode.

1351. Electrolytic restoration of bronze statues and inscribed copper plates. S. Paramasivan. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 53–63, *Jan.*, 1941.—The nature and causes of corrosion of bronzes during long burial in the earth are discussed. A description is given of the method of restoration of large ancient bronzes in the Madras museum by immersion (as anode) in 2% NaOH solution in a Fe tank as cathode. Details are given of current supply and control, purity of electrolyte, duration of treatment and various necessary precautions. N. M. B.

ELECTRONS, NEUTRONS, POSITRONS AND PROTONS.

1352. New model of the point electron of classical theory. E. C. G. Stueckelberg. *Helv. Phys. Acta*, **14**, 1, *pp.* 51–80, 1941. *In French.*—According to the author's theory the electron reacts with the Maxwellian field and a scalar field of the type suggested by Yukawa. The intrinsic energy and the mass (in the equation of motion) of the particle are finite if the same constant ϵ (the electronic charge) governs the interaction with the two fields. The energy-impulse tensor, the equation of motion and the efficiency of radiation, are calculated and compared after the manner of Lorentz. For low frequencies the equation of motion is that of Lorentz, but the "fundamental length" of Yukawa takes the place of the electron radius. The method is finally generalized so as to apply to particles acted upon by several fields of the Yukawa type. The point electron of Dirac appears to be the limiting case of the new model, in which the fundamental lengths tend to zero. Author.

1353. Verification of the theoretical numbers of components into which electronic energy levels are decomposed by crystal fields. S. Freed and S. I. Weissman. *J. Chem. Phys.*, **9**, *pp.* 878–879, *Nov.*, 1940.—The number of component levels into which a given electronic level of an ion is decomposed in an electrostatic field is discussed in respect of the symmetry of the field and the symmetry of the environment about the ions in the lattice in compounds of rare earth metals. The anhydrous fluorides, RF_3, have symmetry D_{6h} and the symmetry of matter about the ion $R^{\cdots}$ is C_{3v}. Combination with BiF_3 yields a mixed fluoride of symmetry O_h. Europium fluoride, EuF_3, exhibits all the levels, a single yellow line at 5 780 Å, 5 in the green between 5 252·3 and 5 241·3 Å, and 7 in the blue between 4 649·1 Å and 4 638·1 Å. The mixed fluoride gives the number of levels predicted, viz. 1 yellow, 2 green and 3 blue lines. W. R. A.

1354. Electron emission of metals in electric fields. I. Explanation of the periodic deviations from the Schottky line. E. Guth and C. J. Mullin. *Phys. Rev.*, **59**, *pp.* 575–584, *April* 1, 1941.—The periodic deviations from the Schottky line can be interpreted as due to the partial reflections of the electron waves on the potential hill at the surface of the metal. These partial reflections give rise to interference and thus to a periodic term in the transmission coefficient for the escaping electrons. The transmission coefficient is obtained by using the functions of the parabolic cylinder to establish the connection between the asymptotic expansions of the wave functions to the left and right of the top of the potential hill. The calculated positions of the max. and min. of the deviations agree with observed positions. It is found that the positions of the max. and min. are sensibly independent of temperature ; and the amplitude decreases as the temperature is increased. The amplitude of the deviations increases with the field. Authors.

1355. Emission of secondary electrons from Ni. R. M. Chaudhri and A. W. Khan. *Phil. Mag.*, **31**, *pp.* 382–393, *May*, 1941.—The secondary electron emission from Ni produced by primary electrons of energy varying from 100–4 000 eV is studied with the primary beam incident on the target at an angle of 45°–50°. For a well-degassed surface the max. value of the secondary emission coefficient is found to be 1·58, the corresponding primary electron energy being about 60 eV. It is also observed that the secondary emission coefficient decreases exponentially as the energy of the primary electrons exceeds this value for degassed as well as for un-degassed surfaces. Authors.

1356. Exchange properties of the neutron-proton interaction. W. Rarita and J. Schwinger. *Phys. Rev.*, **59**, *pp.* 556–564, *April* 1, 1941.—Calculations are made for 3 types of interaction in order to test the sensitivity to variations in exchange properties of experiments on high-energy neutron-proton scattering and on deuteron photo-disintegration by fast γ-rays. The 3 interactions can be described as symmetrical, charged, and neutral. Results for total cross-sections and angular distributions, derived from the 3 theories, are given. Calculations are also carried out for the small cross-sections arising from magnetic dipole and electric quadripole absorption. It is concluded that high-energy photo-disintegration angular measurements would constitute the most valuable test of the isotopic spin dependence of the neutron-proton interaction and also of the existence of non-central forces. G. O. B.

1357. Burst production by mesotrons of spin one-half and zero magnetic moment. S. B. Batdorf and R. Thomas. *Phys. Rev.*, **59**, *pp.* 621–624, *April* 15, 1941.—The cross-section for the initiation of energetic cascades or bursts by bremsstrahlung is calculated for a mesotron of spin $\frac{1}{2}$ and zero magnetic moment. The results are very similar to those obtained by Christy and Kusaka for a Proca particle. AUTHORS.

1358. **Energy loss of heavy ions.** J. KNIPP AND E. TELLER. *Phys. Rev.*, **59**, *pp.* 659–669, *April* 15, 1941.—The energy loss of heavy ions is due to collisions with electrons and with nuclei. The first process is essentially determined by the ionic charge, which in turn depends on the ratio of the velocities of the most loosely bound electron within the ion, and of the ion. The former velocity is calculated from the Thomas-Fermi model, while the ratio of the two velocities is adjusted to empirical data. The nuclear contribution to the stopping cross-section is calculated by the classical method. AUTHORS.

1359. **Scattering of charged mesons.** H. J. BHABHA AND B. S. M. RAO. *Proc. Indian Acad. Sci. A*, **13**, *pp.* 9–23, *Jan.*, 1941.—It is shown that the scattering of neutral mesons by the spin of the heavy particles (g_2 interaction) on the quantum theory agrees completely in its dependence on energy, scattering angle and polarization, of the incident and scattered meson with the scattering on the classical theory (neglecting radiation reaction), except for being larger by a constant factor 3, which is due to differences in the averaging over the initial directions of spin of the heavy particle. On the basis of the assumption put forward by Bhabha, that the heavy particles can exist in states of all integral charge, it is shown that the scattering of charged mesons by the spin of the heavy particles only differs from the scattering of neutral mesons by certain factors for scattering by protons and neutrons, respectively. The scattering of charged mesons on the usual quantum theory shows no correspondence with the classical scattering. The scattering on the basis of Heitler's idea of allowing the heavy particles to exist in higher spin states also shows no correspondence with the classical scattering. AUTHORS.

1360. **Nature of the meson decay.** L. W. NORDHEIM. *Phys. Rev.*, **59**, *pp.* 554–555, *April* 1, 1941.—Theoretical values for the intensity of the soft component due to meson decay are compared with the experimental data. AUTHOR.

1361. **Interaction experiments with resonance neutrons.** H. B. HANSTEIN. *Phys. Rev.*, **59**, *pp.* 489–497, *March* 15, 1941.—A slow-neutron collimator with multiple shielding was constructed for use with the cyclotron, and transmission measurements of high precision were made with neutrons in well-defined regions of the energy spectrum. Cross-sections of selected elements were determined for the resonance neutrons of In and I as well as the Cd absorption group (thermal energy). The experimental work consisted of (1) cross-section measurements of selected elements for In resonance neutrons ; (2) investigation of interference effects ; (3) measurement of the neutron-proton and neutron-deuteron interactions for In resonance neutrons and comparison measurements with thermal neutrons ; (4) measurement of the neutron-proton interaction for I resonance neutrons. The effects of molecular binding should be practically negligible at about 1 eV energy and this is indicated by the fact that the same value of the neutron-proton interaction was obtained for the In and I resonance neutrons, 21×10^{-24} cm^2. From these measurements it would appear that the free neutron-proton cross-section commonly accepted for theoretical calculations, 14×10^{-24} cm^2., should be revised upward. The results show that the method of working inside a collimating enclosure in the immediate vicinity of the cyclotron operates satisfactorily. AUTHOR.

1362. **Neutrino theory of stellar collapse.** G. GAMOW AND M. SCHOENBERG. *Phys. Rev.*, **59**, *pp.* 539–547, *April* 1, 1941.—It is shown that energy losses through the neutrinos produced in reactions between free electrons and oxygen nuclei can cause a complete collapse of a star within ½ hr. Although the main energy losses in such collapses are due to neutrino emission which escapes direct observation, the heating of the body of a collapsing star must necessarily lead to the rapid expansion of the outer layers and the tremendous increase of luminosity. It is suggested that stellar collapses of this kind are responsible for the phenomena of novae and supernovae, the difference between the two being probably due to the difference of their masses. AUTHORS.

1363. **Transmission of an electron density disturbance along a positive column in a longitudinal field.** L. TONKS. *Phys. Rev.*, **59**, *pp.* 522–527, *March* 15, 1941.—The distribution of ions and electrons in the cross-section of a uniform positive column is maintained by the radial motions of these particles. This distribution is designated as normal. A disturbance of this distribution at some point in the column is followed on the anode side by an asymptotic approach to the normal. In the absence of a longitudinal magnetic field the recovery of a normal distribution occurs within a very short distance, but a longitudinal magnetic field slows down the readjustment by decreasing the radial mobility of the electrons. By making certain simplifying assumptions a theory for the approach of a disturbed column back to normal, when the disturbance is cylindrically symmetrical, has been worked out. The distribution is developed in a series of zero-order Bessel functions, and it is found that the first term, which corresponds to the normal distribution, approaches a constant amplitude along the column, whereas successive terms have successively greater space decrements. AUTHOR.

1364. Application of the electron microscope to the study of photographic phenomena. C. E. Hall and A. L. Schoen. *Kodak Res. Lab. Commun. No.* 790. *J. Opt. Soc. Amer.*, **31**, *pp.* 281–285, *April*, 1941.—An electron microscope having a resolving power of less than 50 Å has been built and used to examine photographic emulsions. When photographic crystals are exposed to an electron beam, Ag ions move within the crystals and metallic silver is produced. The crystals disintegrate, cracks and holes developing. Pictures have been made showing very small particles of Ag formed within $AgBr_2$ crystals when they are exposed to an intense light source. Ag reduced from $AgBr_2$ by the common chemical developers has been found to have a filamentary structure rather than the cokelike form as previously believed. Physical development produces clumps of closely packed Ag particles. The smallest photographic crystals (Lippmann crystals), when developed in the common developers, are converted into single threads or ribbons of silver. Authors.

***1365. Combination vacuum-tube switch for double-trace cathode-ray oscillograph, audio-amplifier and mixer.** H. K. Hughes and R. F. Koch. *Rev. Sci. Instrum.*, **12**, *pp.* 183–187, *April*, 1941. [Abstr. 827B (1941)].

***1366. Electronic switch for simultaneous observation of 2 waves with the cathode-ray oscillograph.** H. J. Reich. *Rev. Sci. Instrum.*, **12**, *pp.* 191–192, *April*, 1941. [Abstr. 828B (1941)].

***1367. Electron multiplier as an electron counting device.** Z. Bay. *Rev. Sci. Instrum.*, **12**, *pp.* 127–133, *March*, 1941.—Certain difficulties in the use of counters employing gas-filled tubes can be eliminated to a great extent by the use of high-vacuum multiplying tubes. The construction of tubes of this type using surfaces of high work function is described. A tube of 12 stages with Ag-Mg alloy electrodes gave a total multiplication of 10^8 for an overall voltage of 3 500 V. Thermal emission was entirely negligible and no field emission was observed at the voltage applied. This tube could be operated at room temperature for most applications, cooling with liquid air being necessary only for counting photons of long wavelength. The high-vacuum multiplier has been applied to the counting of α- and β-particles and γ- and X-rays. By comparing the results with those of a point counter mechanism using the same Po and RaE preparations and identical solid angles, it is found that the multiplier method counts every α-particle and probably every β-particle also. The efficiency of counting γ- and X-rays was of about the order of magnitude given by Geiger-Müller counters. A. W.

ELECTROSTATICS.

1368. Electro-optical field mapping. H. Mueller. *J. Opt. Soc. Amer.*, **31**, *pp.* 286–291, *April*, 1941.—As a result of the discovery of an unusually large electro-optical effect in certain colloidal solutions of bentonite it has become possible to study and measure inhomogeneous electric fields by an optical method which is analogous to that of photo-elasticity. Observations with crossed polaroids show 2 orthogonal systems of lines. The isoclinic lines determine the field direction, the isochromatic lines give the field intensity in any point, of a plane field. The method employs a.c. potentials of less than 200 V. Author.

MAGNETISM AND ELECTROMAGNETISM.

1369. Effective susceptibility of a paramagnetic powder. B. Bleaney and R. A. Hull. *Proc. Roy. Soc. A*, **178**, *pp.* 86–92, *May* 9, 1941.—The effective susceptibility of a paramagnetic powder loosely packed into an ellipsoidal container is measured against the vapour pressure of liquid helium, and hence, using previous results [Abstr. 1334 (1941)] against the susceptibility of the compact salt. It is found that the correction to be applied in calculating the Curie temperature from the effective susceptibility of the powder agrees with that given by a theoretical expression derived from Breit's calculation of the demagnetizing field of a powder. Authors.

1370. Spoiling of tungsten magnet steels. C. Wainwright. *J. Sci. Instrum.*, **18**, *pp.* 97–98, *May*, 1941. [Abstr. 834B (1941)].

1371. Mechanism of the variable magnetization of a single crystal of pyrrhotin. T. Okamura, T. Hirone and S. Miyahara. *Proc. Phys.-Math. Soc., Japan*, **23**, *pp.* 132–142, *Feb.*, 1941. *In German.*—The Barkhausen effect is investigated in a pyrrhotin bar cut from a natural crystal, the axis of the bar coinciding with the direction in the crystal of easiest magnetization. A search coil containing the specimen is connected through an amplifier to one pair of plates of a Braun tube and the other pair to a source of e.m.f. for time measurements. Oscillograms are taken by camera and are corrected and interpreted from a given theory. It is considered that, for the specimen tested ($15{\cdot}6 \times 1{\cdot}48 \times 1{\cdot}50$ mm.), 16 000 Barkhausen steps must have taken place between $-I_\infty$ and $+I_\infty$. Also, the sudden change in magnetization is brought about by a sudden growth in the volume of the elementary regions, and the speed of growth of these must be constant at each step. The magnitude of an elementary region is large compared with the values found by Tyndall [Abstr. 677 (1925)] and Bozorth and

Dillinger [Abstr. 5248 (1932)]. This is attributed to the non-metallic nature of the pyrrhotin. G. E. A.

1372. Space closure of periodic orbits in the field of a magnetic dipole. O. Godart. *J. Math. Phys.*, **20**, *pp.* 207–217, *April*, 1941.—Störmer's Hamiltonian equation for the motion of a charged particle in the field of a magnetic dipole is discussed. Periodic orbits for the particle are computed. G. C. McV.

1373. Solid free radical as catalyst for ortho-para hydrogen conversion. J. Turkevich and P. W. Selwood. *J. Amer. Chem. Soc.*, **63**, *pp.* 1077–1079, *April*, 1941.—The magnetic characteristics of α, α-diphenyl-β-picrylhydrazyl, the corresponding hydrazine, active zinc oxide and ignited zinc oxide, were determined. Authors.

1374. Discontinuities of magnetostriction and magnetization in Ni. C. W. Heaps. *Phys. Rev.*, **59**, *pp.* 585–587, *April* 1, 1941.—When the magnetic vector of a domain reverses direction there will be no magnetostrictive changes in the domain. If the vector jumps through some angle other than 180°, a sudden redistribution of strains will be caused by the change of magnetostriction and a sound wave will travel out from the domain. Simultaneous records have been secured of the sounds and of the magnetization jumps when the magnetization of a Ni wire changes. These records indicate that reversals occur mainly when the magnetization of the specimen is weak. Jumps through angles other than 180° occur in regions of strong as well as weak magnetization. Author.

MEDICAL RADIOLOGY & ELECTROLOGY.

1375. Dependence of the biological effect of radiation on intensity and wavelength. D. E. Lea. *Amer. J. Roentgenol. & Radium Ther.*, **45**, *pp.* 605–613, *April*, 1941.—A determination is made of the dose required to produce death in chick embryos within 2 or 3 days after irradiation, various conditions of intensity and wavelength being employed. The effect of a given dose delivered in a single exposure, if the intensity is greater than about 10 r/min., is found to be practically independent of intensity. The effect is reduced, however, by spreading the dose over a long period, and it is thought that this may be due to partial recovery. The doses of γ-rays and of medium and soft X-rays required to produce the same effects are compared. J. T.

1376. Inverse square law errors in γ-ray dose measurements. F. W. Spiers. *Brit. J. Radiol.*, **14**, *pp.* 147–156, *May*, 1941.—An examination is made of the effect of finite condenser size on γ-ray measurements in close proximity to radium sources, and of the limitations imposed on the use of standard types of condenser ionization chamber. The calculations given agree well with experimental findings. An estimate is given of possible correction factors which can be applied to practical cases of dose measurement. J. T.

OSCILLATIONS AND WAVES.

1377. Oscillator strength for the liquid phase. A. I. Mahan. *J. Opt. Soc. Amer.*, **31**, *pp.* 248–259, *March*, 1941.—The paper gives a discussion of the methods involved in evaluating the oscillator strengths from both the dispersion and absorption equations for liquids. The resulting equations are applied to a set of infra-red bands on which the absorption and dispersion were measured. Author.

PHOTO-ELECTRICITY.

1378. Photo-electric emission from an oxide-coated cathode and the exact determination of its work function. E. Nisibori, H. Kawamura and K. Hirano. *Proc. Phys.-Math. Soc., Japan*, **23**, *pp.* 37–43, *Jan.*, 1941.—It has been found that the spectral sensibility curve does not intersect but approaches the frequency axis exponentially, and a special procedure has been devised to obtain the threshold value. The photo-electric threshold values thereby determined for BaO and SrO are 1·63 eV and 2·58 eV, respectively, which are greater than the thermionic work functions. Further, the work function of the solid solution of BaO and SrO is almost equal to that of BaO. Experimental details with data and diagrams of apparatus used are included. H. H. Ho.

THERMIONICS.

1379. Thermal activation of the O_2 molecule. H. D. Hagstrum and J. T. Tate. *Phys. Rev.*, **59**, *pp.* 509–513, *March* 15, 1941.—A study of the relative partial pressures of O_2 and the impurities CO_2, CO and H_2O upon the temperature of a Pt filament operated in oxygen at low pressure (about 10^{-4} mm. Hg) has been made. The Pt filament was contained in the vacuum system of a mass spectrometer which was used as a partial pressure gauge. It was found that the partial pressure of oxygen began to fall at a filament temperature of approximately 1 280°K. and had dropped to 46% of its original value at 1 740°K. This fall in the O_2 abundance was accompanied by rises in those of CO_2, CO and H_2O. Finally, the effect completely disappeared. The dissociation of H_2 by a hot W filament has also been investigated and results in accord with previous work obtained. Authors.